

EDITORIAL
LIBRARY

Desktop ISDN

PC Labs Tests 18
Adapters to Pump
Up Your PC's Bandwidth



NETWORK EDITION

C++ Programming

Tools to Take Away
The Coding Pain

NT Firewalls

Are They Ready
To Take On Unix?

MAGAZINE

MMX

THE NEW GENERATION OF

PENTIUM

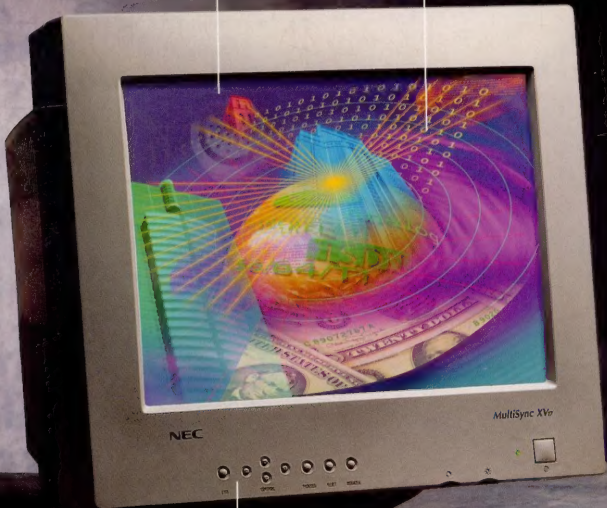


"...bright screen, superior on-screen controls and low price."

Windows*

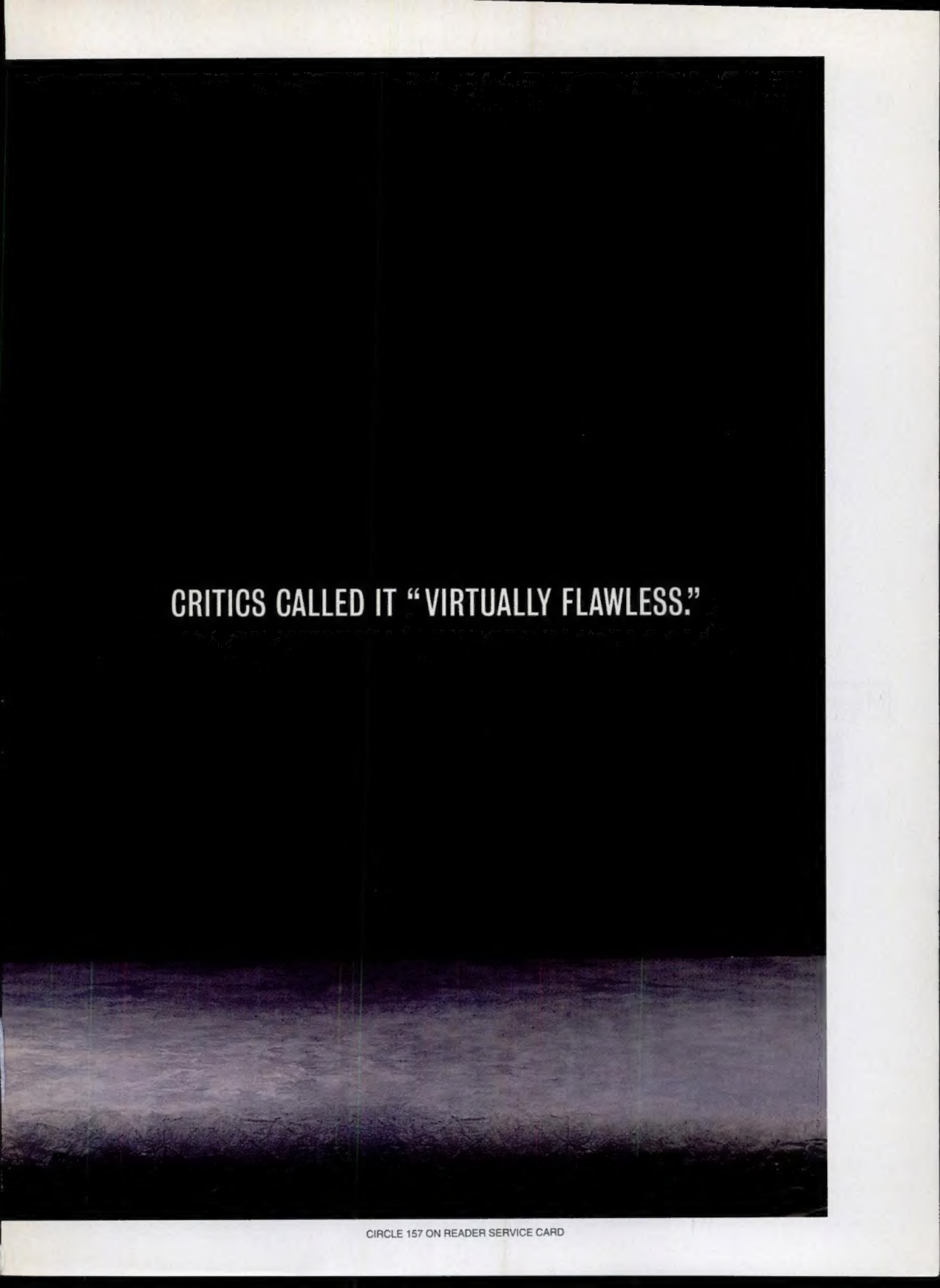
"...great picture quality, advanced features, and top-notch support... a superb monitor."

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**takes the Internet
and gives it a good
in the messaging**



Global Address List



Internet Mail Service



Add...



Microsoft Exchange Administrator - [Server NYOFF]



File Edit View Tools Window Help

Enter the



Display Name

Business



Chicago

Internet Mail and News



Hong Kong



New York

Microsoft Exchange



You have received new mail.

Do you want to read your new m

Yes

No

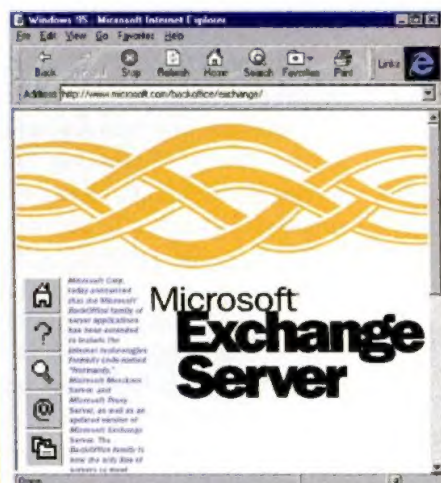
swift kick and collaboration tools.

Ins Container  Encryption

in Site TRGI - Recipients]
ame of your POP3 server.

Subject

- ☐ Short-term strategy—first draft Bob
- ☐ Why Bob is wrong Mike
- ☐ Re: Why Bob is wrong KateT
- ☐ Re: Why Bob is wrong ElkeD
- ☐ Second draft strategy Bob



The new [Microsoft® Exchange Server 5.0](#) brings together the best features of an industrial-strength messaging system—the reliability, the scheduling, the rules-based message management—with the enormous scope and flexibility of the Internet. Microsoft Exchange is built on current industry standards, so it works across all the major network environments, in harmony with all the major messaging systems, all while delivering superior manageability and reliability. Meanwhile, [Microsoft Exchange](#) supports all the

popular Internet protocols and standards, so you can extend all this goodness to [the Internet](#). Now ordinary individuals can set up discussion groups. Far-flung teams can begin collaborating. Users can access their mail from any standard e-mail client anywhere—even from a Web browser. In short, [Microsoft Exchange](#), proud member of the [Microsoft BackOffice™](#) family, gives you a comprehensive messaging and collaboration system that knows how to make the Internet perform. And that, my friends, is the best of both worlds.

Microsoft®

Where do you want to go today? www.microsoft.com/exchange/trial/

The Quick Fix



One of the more fascinating uses of the Internet is providing updates or patches to existing applications. Thanks to the Internet, owning software and keeping it up to date is getting a lot easier. When you get a new program, you can register it online with a few clicks of your mouse. It's much simpler than filling out a registration

card. Once you've registered, the company can notify you by e-mail whenever a new version becomes available. In many cases, you can download and install the update automatically.

Like many trends in the computer industry, online registration started with Internet software. Programs such as PointCast inform you of new versions, which you can download painlessly. I'm not sure why neither Microsoft Internet Explorer nor Netscape Navigator supports this yet, but I'll bet they will fairly soon.

This concept is proving to be useful in other software categories as well. Thus far, it has had the most impact on utilities. Programs like CyberMedia's Oil Change, which builds a profile of your system and automatically downloads new versions of drivers, are based on this concept. And now comes the migration of more traditional utilities: Symantec recently introduced a feature called LiveUpdate for Norton Utilities, Norton AntiVirus, and other programs. Quarterdeck has a similar feature, Update-It, for such products as its CleanSweep uninstaller. Other vendors are following suit. Marimba's Castanet, for example, is designed to do the same for Java-based programs.

In many cases, this approach makes a lot of sense. Antivirus programs, for example, can be continually updated to ensure protection against the latest viruses. Many antivirus programs already offer regular updates, but getting the virus definition files automatically from the Internet is more convenient.

In general, the concept of downloading software updates from the Net is a good thing. It allows users to keep their software up to date and to obtain quick fixes on command. And if properly adopted for corporate networks, this technology could allow organiza-

tions to update client software more quickly and easily, without having to carry programs around to each workstation.

There are some downsides, though. Some of the programs I've used remind you to register too often. Sometimes the update simply doesn't work right. And sometimes you can't choose how often to check the Internet for new updates. If you have a fast connection,

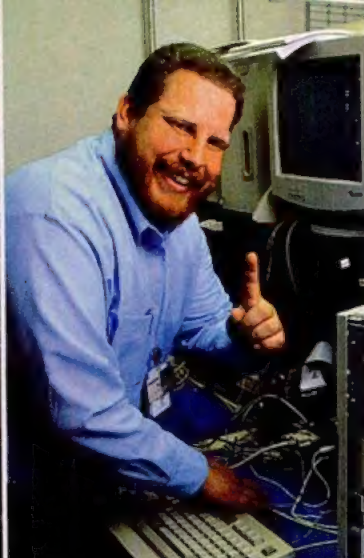
that's not a problem. But if you use a modem and you pay for the time, you don't want your software to run up the phone bill. In the long run, I'd like to see programs that can take advantage of downtime—when you're already connected to the Net but reading a cached Web page, for example—to check for new patches and then download them. These are just technical concerns, however, and I'm sure they can be worked out in the near future.

But a more pressing concern exists. Have you noticed lately that more programs seem to have more problems? It seems that many major program releases are closely followed by an ".01" release or an "a" release—designed to fix a fundamental problem in security, functionality, or compatibility. This is especially common with Internet software (perhaps because the release schedules are so frequent anyway), but it's also creeping into other categories.

I worry that the ability to update programs more easily is leading some vendors to take shortcuts and start shipping before the programs are really ready. After all, they might rationalize, if users notice some problems, we'll provide a fix. That means the early users—often the best customers—are getting the worst software. Not a good policy.

The ability to fix bugs and send patches automatically through the Internet is a good thing. But it's not a substitute for shipping quality software. And we should demand nothing less of software vendors. □

Michael J. Miller
MICHAEL J. MILLER



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GOOD	GOOD	GOOD
APPLE AT&T COMPAQ DIGITAL HEWLETT-PACKARD	AT&T DIGITAL	DIGITAL HEWLETT-PACKARD
FAIR	FAIR	FAIR
GATEWAY 2000 IBM QUANTEX	GATEWAY 2000 IBM NEC	ACER APPLE AT&T COMPAQ GATEWAY 2000 IBM HEWLETT-PACKARD QUANTEX

PC World Reliability & Service Survey—*PC World*, December 1996



July 1994



January 1995



December 1995



December 1996

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COVER STORY



MMX Extends the Desktop

BY CADE METZ

For many, the appeal of a PC lies in the razzle-dazzle multimedia tricks it can do. If that applies to you, then celebrate the arrival of systems built on Pentiums with Intel's MMX Technology. MMX boosts audio, video, and image rendering and processing, and it adds only about \$50 to \$100 to the price of a classic Pentium. While our tests show roughly a 10 percent improvement for standard business applications, the most significant gains are for early MMX-enabled titles. Here's our review of the first 12 MMX systems to hit the market.....100

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ONLINE



What's New Online

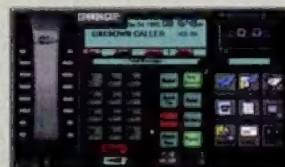
MMX Speed
Join us at www.pcmag.com to use our exclusive

interactive benchmark test viewers to sort through all the test results for this issue's evaluation of MMX-based systems by whichever criteria interest you most. Also on the Web: daily Trends updates.

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ISDN ADAPTERS

Digital Dragsters

BY LES FREED ISDN keeps gaining on itself, and high-speed ISDN adapters appear ready to zoom past the default choice for desktop connectivity—analogue modems. This year's crop of 15 ISDN adapters for the desktop are faster and less expensive. Getting connected to ISDN service is still a challenge, but most of these adapters come with ISDN line-ordering help. Some vendors will help provision an ISDN line from your telephone company.....137



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PROGRAMMING

C++ Adapted for RAD

BY DOUGLAS BOLING Get ready for a new breed of C++ development tools, one that borrows from the speed of visual rapid applications development (RAD) tools while keeping the power of C++. These new visual environments are battling it out with traditional integrated development environments (IDEs) for the hearts and minds of C++ programmers in every development category. The face of C++ programming is changing with the times: We test the latest tools of both types and preview groundbreaking new releases just about to ship.....189



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HARDWARE

CD-R Drives: Just One Step Away

BY JONATHAN HILL It's cheaper and easier than ever before to record your own CD-ROMs. We review 15 hardware/software bundles for about \$1,000 or less. You can take full advantage of the fact that many desktops have CD-ROM drives—and most new systems ship with them. But be careful: You'll still need to take great care in putting together your CD-R station. In this developing market, small variations in software and the like can make for big roadblocks.....171



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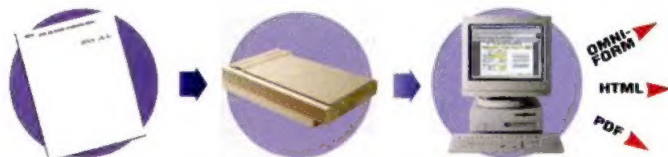
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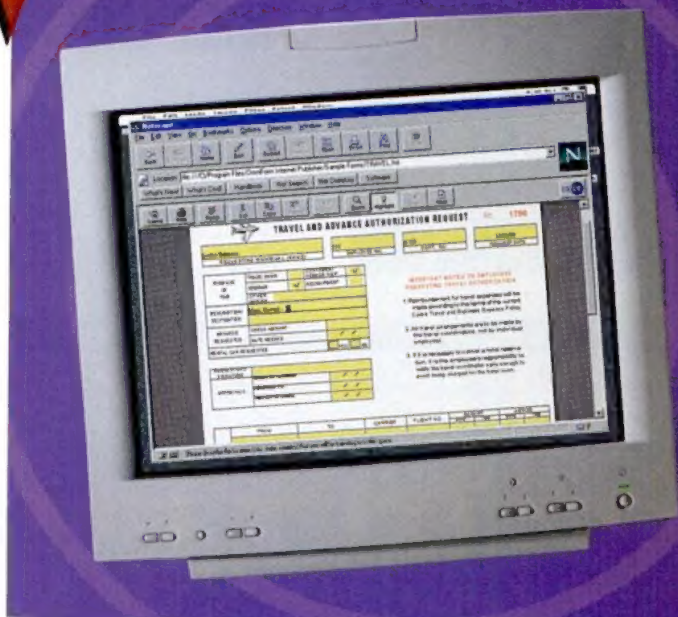


design tools to modify each form. These forms are totally editable and can even perform mathematical calculations and validation—something that can't be done in HTML. Best of all, virtually everyone can fill them out thanks to Caere's free filler plug-in for Netscape Navigator and Internet Explorer. Or if you prefer, you can save your Web forms to either HTML or PDF formats. So call or visit our Web site today for more information.

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Pipeline



Room Service? Send Up A T1 Line, Please

Try getting onto the Internet from a hotel—especially one filled with notebook-toting business travelers—and the connection will in all likelihood be as slow as molasses.

How about paying an extra 10 bucks per night to get high-speed Net access right from your hotel room? That's the plan San Jose-based 4th Network has in mind. By the end of the year, the company plans to provide 100 to 200 hotels with full Internet setups.

4th Network has installed 1.5-Mbps T1 lines (or, in some places, 400-Kbps satellite connections) to the Internet in the business centers and lobbies of several Embassy Suites, Hilton Hotels, and Holiday Inns, mostly in the San Francisco Bay Area. But who wants to traipse down to the business center or lobby in pj's to surf the Web?

Nobody—that's why the company is launching in-room installations, the first of which will take place in a 500-room hotel in Silicon Valley, says Scott Har-

mon, 4th Network cofounder.

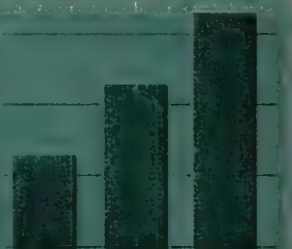
4th Network makes money by taking the lion's share of the fees the hotel charges guests for access—from 15 to 50 cents per minute. Rate structures aren't in place yet, but in one scenario, the hotel might charge guests a \$10 fee per night for unlimited access. In another pricing model, the hotel might charge per minute.

The company also gets a share of the revenues of its partners, Web sites and services such as BigBook and HotMail, that are of particular interest to business travelers. "We funnel excellent demographics to them, which makes their advertising models work," Harmon explains. Hotel guests access the Web through 4th Network's Traveler Browser.

Outside the U.S., 4th Network will rely mostly on satellite links in order to avoid the red tape involved in getting Internet access through separate government-owned phone systems. Hotels in London and Tokyo should be Internet-enabled by mid-1997.

Web Ads Add Up

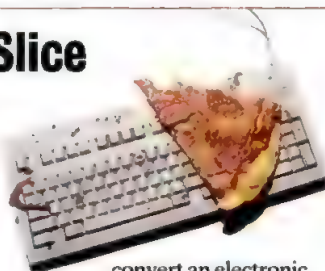
After faltering during the summer months, Web ad revenue for 1996 regained its footing in the third quarter, according to a Jupiter Communications study. In fact, the third quarter generated five times as much revenue as the fourth quarter of 1995 did.



The Latest Web Slice

Pizza and sleepless nights are long-time staples of the serious hacker, and a start-up Seattle firm called CyberSlice (www.cyberslice.com) has its sights set on the pizza part of that equation. The company's founder, Tim Glass, got the idea after watching actress Sandra Bullock order a pizza online in the movie *The Net*.

Glass is in partnership with over 150 independent pizza restaurants in the Seattle area and is forming similar partnerships in New York, San Francisco, and elsewhere. CyberSlice has crafted its own text-to-speech software to



convert an electronic pizza order—including address, phone number, and toppings—into an audio one that's sent to the restaurant over the phone. CyberSlice's cut for every pie is 3 to 10 percent of the total cost.

If participating restaurants can add Jolt cola to their menus, computer users—or, at least, hackers—may sit up and take notice.

An Rx for Norton Disk Doctor

Users of the new release of Norton Utilities, Version 2.0, should be aware of a possible conflict involving Symantec's utility, OS/2 Warp, and Microsoft Windows. While reviewing the utility on a PC that previously had OS/2 installed, *PC Magazine* contributing editor Edward Mendelson found that Norton Disk Doctor reported invalid filenames in many of his directories and offered to repair them.

The "repair" changed the original names to generic, numbered names. The Undo feature restored the originals, but anyone who experiences this error may be tempted to remove the files and restore from backups, losing recent data.

The invalid filenames were, in fact, perfectly usable by Windows 95. Mendelson was able to restore proper filenames through a fix available on Symantec's Web site. The company plans to incorporate the fix into the installation routine for Norton Utilities.



Online: Customized Views

MMX. The most important CPU innovation since the Pentium Pro has finally arrived. Our exclusive interactive benchmark test and price/performance viewers and our interactive summary of features will let you sort the results for all the MMX-based PCs evaluated in this issue's cover story by whichever criteria interest you the most.

ALSO ON THE WEB. Join our freewheeling discussions, and be sure to check in with weekly commentators John C. Dvorak, Michael J. Miller, and Don Willmott for interesting gossip, answers to your questions, and opinions on life on the Internet. Feel free to talk back to them, too. Our new easier-to-use discussion forums will help you make your feelings known.

Pipeline

Checkmate, Lowly Human

In a narrow victory for humans over machines, World Chess champion Garry Kasparov last year won a match against an IBM supercomputer called DeepBlue that's capable of evaluating one billion chess moves per second. Kasparov lost several games



to the machine, though—a fact that has a team of IBM engineers shouting for a rematch.

Programming chess computers has fascinated scientists since the 1950s, because chess doesn't depend as much on chance as it does on nonlinear tactics and planning. For example, a world-class chess player

like Kasparov will often envision the endgame position of his remaining pieces before making the first move.

As IBM's DeepBlue FAQ puts it: "What happens when a human player offers a gambit? In

evaluating whether gaining a piece makes up for a loss of positional strength, the computer is not comparing apples to apples."

IBM hopes to apply DeepBlue's technology to other kinds of decision-making situations, such as investment.

A second, reprogrammed computer is scheduled for a rematch with Kasparov by the year 2000.

For his first victory, Kasparov received \$400,000 from IBM, although he said he played "to defend human dignity."

The Internet—in Chinese

The Internet remains a remote concept for the vast majority of China's 1.2 billion people. After all, the first Internet connection there was set up only in April, 1994, and most Web content is in English. Software developers, though, are starting to tear down the language barrier.

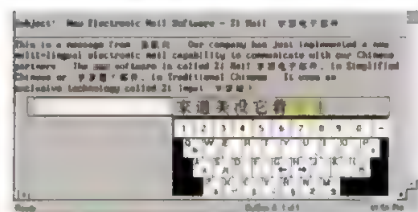
ten keys and follows the stroke order students learn in school. According to the company, any of the 50,000 Chinese characters can be entered with an average of 2.7 keystrokes. The software also lets you view Web pages in Chinese, type in Chinese, and mix English and

Chinese in the same document.

Other techniques for inputting Chinese characters include *wubi*, which requires you to memorize numerical codes for each character, and pinyin, a phonetic system based on 485 sounds, which

requires you to type the sequence of characters that correspond to a sound; from a list of possibilities, you hunt for the character you want.

Initially focused on the Hong Kong marketplace, Zi Corp. has recently entered strategic partnerships to expand into China.



MULTILINGUAL E-MAIL: Zi Corp.'s input system uses just ten keys to enter any Chinese character.

Three-year-old Zi Corp., with outposts in Calgary, Hong Kong, San Francisco, and Beijing, recently launched an e-mail program called Zi Mail and a Web browser called Zi Browser, both based on an innovative input system called Zi Input. The system uses just

THIS ISSUE'S CONTRIBUTORS: Regina Kwon, Carol Levin, Sebastian Rupley, and Don Willmont.

Netting a Job

Although most companies still rely on newspaper ads to entice prospective employees, human-resources managers are increasingly turning to the Web.

Virginia-based search firm Paul Tittle Associates, which caters to the information systems industry, joined up with Career-Mosaic (www.careermosaic.com) with encouraging results. The company posts 50 to 100 ads at a time and has placed at least 20 candidates who surfaced over the Internet.

The savings garnered by using online job services may be a major attraction. Running an ad of, say, 20 lines through an online service like CareerMosaic or The Monster Board (www.monsterboard.com) costs \$100 to \$150 for 30 days. A similar ad in *The New York Times* can cost up to \$1,728 for a week.

Meanwhile, research firm Forrester Research suggests that the high traffic of online employment services might encourage those sites to take up a free-listing, advertiser-supported model.



Smart TV

A long-awaited accord on PC-friendly standards for high-definition TV has been struck, but it may be a while before HDTV reaches your family room. In the short term, new software and hardware products herald the convergence of PCs and TVs.

By mid-1997, Microsoft plans to ship an interface for TVs that navigates both the Web and TV. Featuring a channel-like design, the interface may connect with a new breed of remote-control devices. Microsoft has had its eyes on various marriages between TV and Web content—including an investment in WebTV and a partnership with Hughes for DirecTV satellite transmissions.

ATI Technologies is working on an under-\$500 card that will receive satellite TV signals and will work with the new Microsoft TV interface. ComStream and STB are also working on PC cards that receive satellite TV signals.

Several PC manufacturers have announced plans for 1997 launches of PC/TV systems based on the upcoming hardware and software.

Top Retail Business Software

- 1 Microsoft Windows 95 Upgrade Microsoft
- 2 Norton AntiVirus for Windows 95 Symantec
- 3 VirusScan McAfee
- 4 Netscape Navigator Netscape Communications
- 5 Corel WordPerfect Suite Upgrade Corel
- 6 Microsoft Plus! for Windows 95 Microsoft
- 7 Netscape Navigator Gold Netscape Communications
- 8 Netscape Navigator Personal Edition Netscape Communications
- 9 Norton Utilities for Windows 95 Upgrade Symantec
- 10 First Aid Deluxe Cybermedia

Source: PC Data. Data for October, 1998.

Corel Beats Microsoft in U.S. Office Suite Retail Sales for Four Straight Months

It's official. Corel® WordPerfect® business applications have consistently outsold the competition in U.S. office suite retail sales *for four months running*. Corel now has a 10% lead over Microsoft and more than 8 times the unit sales of Lotus.

Corel's exceptional office suites for Windows® 3.1x and Windows® 95 offer a unique combination of wide-ranging functionality, superior business tools and groundbreaking Internet support. They enhance productivity, add professionalism to your communications and open doors to exciting new worlds. In fact, they're far and away the most advanced, most comprehensive business software solutions on the market.

Five months on store shelves. Four months of phenomenal sales. Only radically innovative software could reach such impressive heights in so little time. Corel WordPerfect. It's unbeatable.



- Advanced Technology
- Incredible Value
- Comprehensive Internet Connectivity

PERCENTAGE OFFICE SUITE MARKET SHARE				
Company	June*	July*	August*	September*
COREL	53.4	52.0	50.1	50.9
Microsoft	40.8	42.8	43.1	40.7
Lotus	5.2	4.2	5.5	5.8

* Data received from SoftTrends, the premier PC software tracking service. Based on unit office suite sales for MS-DOS, Windows and Windows 95 at retail.

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**Source: PC Week, October 21, 1996, page 128.

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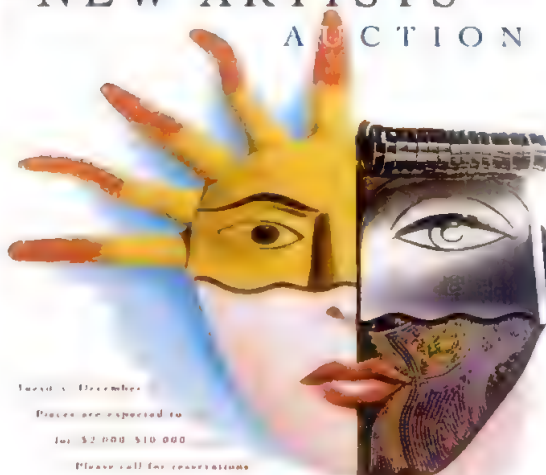
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Letters

ISP WHEELING AND DEALING

I applaud your attempts to cover Internet Service Providers (ISPs) in your November 19, 1996, article "The Net Grows Wider." Unfortunately, each ISP changes its pricing plans about as frequently as long-distance phone companies change their rates. Just as your issue arrived, America Online (AOL) came out with a new pricing policy, and CompuServe delivered its new 32-bit interface.

HENRY CHOW
Harrisburg, North Carolina

Please remember that it was the ISP community that got the Internet ball rolling, and that it was only after the independents really started making waves that the likes of AOL, AT&T, CompuServe, MCI, SPRYnet, Prodigy, Microsoft, and the rest woke up and started offering direct Internet access.

RICK WAGNER
via the Internet

Your article on ISPs would have been much more helpful had it included some information about each system's reliability. Frequency of busy signals, spontaneous disconnections, data throughput rate, and completeness of Usenet news feeds are much more important than a list of included software.

MARK SIEGEL
New York, New York

When you review ISPs, I think you should evaluate performance in large metropolitan areas by picking several major Web sites and recording the time it takes to load a page from each of the major cities. A test of FTP throughput would also be nice.

JON GREISZ
Dallas, Texas

I was disappointed that your review of ISPs didn't include testing performance in downloading files. I have found huge differences



My conclusion is that ISPs provide better performance than traditional online services.

phone lines, and region of the country affect how reliably and quickly you can connect to any ISP.—Ed.

CHOICE OF ANOTHER GENERATION

Even though I'm a small-time Web designer, I find that having to deal with America Online is a real pain. I simply can't understand why you selected it as your Editors' Choice. AOL is slow and has a habit of forgetting to remove you from their service when you cancel it. Almost everyone I know who signed up for the free 10 hours found themselves still being billed by AOL long after they canceled the service.

ED CHMIEL
via the Internet

I was absolutely astounded that you could have selected America Online as an Editors' Choice when it still doesn't support 32-bit

LOST AND LONELY

I found your November 19, 1996, cover story, "Suite Peeks," to be most helpful and interesting. I take issue, however, with the fact that it focuses mainly on Windows 95 suites. You completely neglected the Corel Office Suite for Windows 3.x. Corel has publicly stated its commitment to that operating system, and it would have been interesting to know of that suite's strengths and weaknesses.

XAVIER BASOR
via the Internet

The Windows 3.1 version of the Corel suite has not significantly changed from the suite Novell sold under the Perfect Office name. The core applications haven't changed (aside from patches), although Corel has added lots of goodies.—Ed.

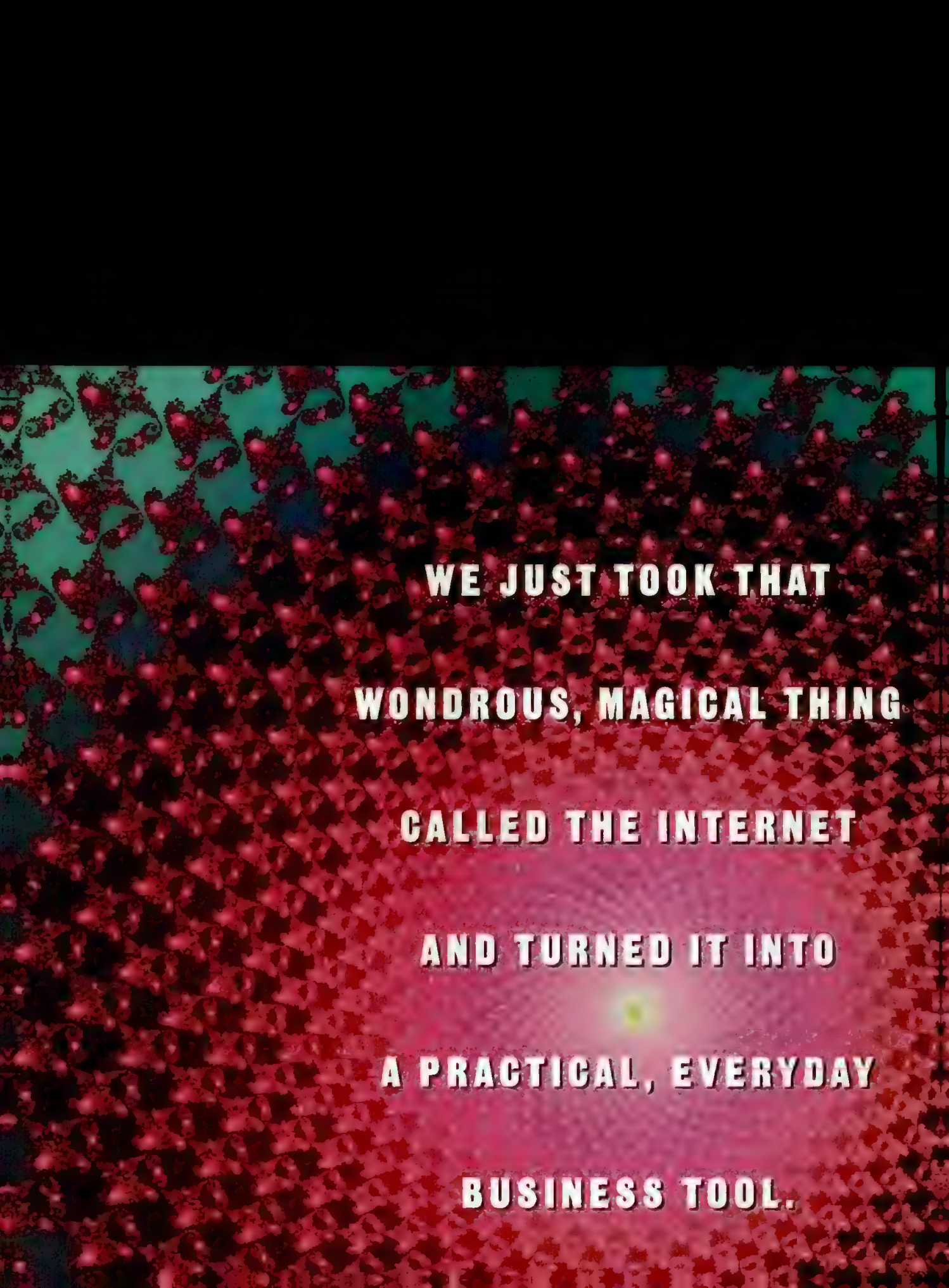
WHAT ABOUT WIN 3.x?

Jim Seymour's observation that Windows 3.11 and DOS will remain players was right on the mark ("That Hot New OS—Win 3.x," November 5, 1996). I run a small business and don't fit the mold of a large MIS department. We've put the brakes on further upgrades to Windows 95 and Windows NT after unsuccessful tests on several of our PCs. It cost us \$3,000 in time and software to upgrade one machine to Windows 95, and it crashed constantly. We are in business to make a profit, and we need reliable computers and efficient software to do so.

DAVID GOODYEAR
via the Internet

I'm amazed at Seymour's commentary on Windows 3.x. This is one of the most blatant examples of new-product bias I've ever seen. From his article, it appears that merely the fact that a newer OS exists is a good enough reason for upgrading. Why does he (and so many of his fellow journalists) persist in maintaining the mentality that says the newest item is a must have?

ALAN MANDEL
Framingham, Massachusetts



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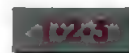
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Letters

Microsoft FrontPage 97 was still in beta when we put the story together.—Ed.

I liked the First Looks article on mapping software ("On the Road Again," November 5, 1996). But there's a cheaper and more accurate way of finding any street in the world. Mapquest's Web site (www.mapquest.com) can pinpoint any address in the world and can even make a trip plan to get you there. You can find out where to eat and sleep, where gas stations are located—and the best part is that it's free.

FRANK MARTELLI
via the Internet

NO EXPERIENCE NECESSARY

Concerning Bill Machrone's column "Web Power Tools: The Cutting Edge?" (November 5, 1996), I've had a terrible time getting my personal Web server to operate, as well as Microsoft's FrontPage Explorer. Microsoft's claim that absolutely no programming experience is required is way out of line. The average Joe is entirely unaccustomed to tinkering with Windows 95 network settings and the like. More important, due to the way that FrontPage's extensions are set up on the ISP's server, Webmasters must manually restart the server that hosts their Web page every single time they send a new page or modify an existing one.

RON D'AMICO
via the Internet

MISSING IMAGE?

The November 5, 1996, Trends article "Web Photo Finish" mentioned services that process film, allowing you to receive the photo images via the Web, alter the images with proprietary software, and request reprints via the Web. But

HOW TO CONTACT US

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We regret that we cannot answer letters individually. To send submissions for PC Solutions, please see the sidebar "How to Contact Us" on the last page of that column.



CORRECTIONS AND AMPLIFICATIONS

In the First Looks article "Data in the Fast Lane" (December 3, 1996, page 45), we incorrectly stated that The Microsoft Network and America Online endorsed Rockwell's standard for 56-Kbps modems.

The review of Pentium and Pentium Pro desktop computers in our issue of December 3, 1996 ("Choose Your 200," page 198), included an incorrect phone number for Polywell Computers. The correct number is 800-999-1278.

it failed to mention Seattle Filmworks, which has been doing this for a while already.

DAVID SHINN
Murphysboro, Illinois

NET INVADERS

I enjoyed John C. Dvorak's article "Rude Newsgroups Run Rampant" (November 5, 1996). I agree that this is a major problem. I just wonder if a newsgroup server can be programmed to limit the number of messages from a particular address, or even delete all the messages from an address if the address sends an unreasonable number of messages in a day.

LI-PING YUAN
via the Internet

Dvorak hit the nail on the head with this one. When Microsoft dropped its CompuServe forums for Internet-only support, I was forced into the newsgroup arena. What a debacle. With CompuServe, I was the type of user who would surf through questions, offering help if I knew the answer. I've ceased doing this, as have many others, which is obvious by the number of questions that go unanswered. Why? Because there's so much infantile behavior to wade through that it seems like a complete waste of time. In their present form, most newsgroups can't be viewed as business resources.

DAVID FOSBENNER
via the Internet

Dvorak commits two grievous errors in his column decrying Usenet newsgroup flaming. Referring to publicly posted messages as "e-mail" confuses the issue of annoying content on the Net. Worse still, Dvorak goes on to insult wargamers of all stripes, not just the "pathetic adults who wish they were still teenagers playing Dungeons and Dragons." Sophisticated role-playing games are the Holy Grail of computer entertainment, and it's already part of the Net that Dvorak loves to hate.

JAMES ATCHISON
Victoria, British Columbia, Canada

A LITTLE RESPECT

I just finished reading Bill Machrone's November 19, 1996, column "Computer Viruses: Myth vs. Reality" and agree that there are a lot of false scares and hoaxes out there. But computer viruses are nothing to take lightly. I am glad Machrone and his family have not been hit with a virus on their home PCs, but as one who has had to rebuild a hard disk because I forgot to

scan a data disk before using it, I respect viruses and their potential dangers.

WILLIAM A. DIVICINO
via the Internet

I was shocked by Machrone's article regarding computer viruses. It is irresponsible to tell the readership not to panic about computer virus infection. As an administrator for a ten-person network, I have encountered viruses many times. In all these instances, the viruses were easily detected and purged. In my opinion, the threat of infection is a very real possibility for all computer users and owners. But the damage caused by these infections is what has been wildly overblown by users and media alike.

BRUCE E. HOUCK
Houston, Texas

TECH TALK

I found the PC Tech/Tutor article "Beware the Word Macro Virus" (November 5, 1996) very informative, though it might cause some problems. I develop many Word macros and often use the AutoOpen macro to get started in a Word template, and I want to clarify that having an AutoOpen macro in your list of macros doesn't automatically mean you have a virus.

MARK E. RANUM
via the Internet

I liked your October 22, 1996, PC Tech article "Java Speed Trials" but found two things missing. I would have liked a comparison of JIT (Just In Time) compiled Java code with native C or C++ code. I also wish you could have offered a better idea of where the code was executing and in what way the development environments were being compared.

MITCH GART
via the Internet

ON COMMON GROUND

Bill Machrone's October 22, 1996, column "The End of Common Experience" reflects my thoughts. Processing the sheer amount of raw information we are exposed to each day is a daunting task. I wonder what will become of our social skills and can only hope that Machrone's suggestion is true—that the artificial walls with which we surround ourselves will become too constraining and we will once again yearn for a "common experience."

KC GOEWY
via the Internet

Monkey on your back #28: How to turn your PCs into real Windows NT[®] clients without really turning your PC users off.



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grill of .25 mm, and refresh rates as lofty as 150 Hz for virtually frozen screens. They are even capable of the ultimate 1600 x 1200 resolution. In other words, these screens are not just larger, they are clearer—which translates directly to improved working conditions and user-sensitivity. You'll also be relieved to know these are the first monitors to be TCO'95 certified for greatly reduced screen



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emissions. This reaffirms Nokia's leadership in the science it pioneered.

The media-ready series does more than extend Nokia's most award-winning model (7 industry "Bests" so far). It literally shouts innovation. Dual powered stereo speakers in front combine with a subwoofer in the swivel/tilt base to shape audio at the intimate volumes most suitable for working close to a monitor.



447Xavc—Adds to X series features with built-in color video camera

This gives you the kind of audio system that multimedia and communications applications require, without a nest of wires and speakers fighting for the precious real estate around your computer.

The audio capabilities of the media-ready series extend to the built-in microphone set in the top of the bezel (at ideal voice height). This feature completes the requisites for computer telephony. The 447Xavc model even houses the world's first inboard color video camera for video-capture and conferencing. Truly, the media-ready series enables the complete convergence of computing and communications.

Of course, each of these systems comes with full digital controls and on-screen menu-driven adjustments (which Nokia also pioneered). Yet their pricing is remarkably competitive. All of which makes the new 447X series a necessity for anyone making full use of their computer. After all, the best way to meet the standards is to work with the people who set them.

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Trends

Stay Tuned for HDTV

The long-awaited standard leaves room for interpretation.

After a decade of battles among the personal computer, television broadcasting, and film industries over standards for high-definition television (HDTV), an agreement has finally been reached. The negotiations set the arrival of next-generation, crystal-clear digital TV signals on both PCs and TVs "less than two years away," according to Reed F. Hundt, chairman of the FCC, but also leave many questions about incompatible digital TV devices up in the air. Analysts agree that convergence between digital TV signals and PC applications would hugely benefit both the television and the computing industries, but they also expect further skirmishes over how the new standard makes its way into products.

FIRST, A DISAGREEMENT

Both industries anticipate big revenues from the convergence of PCs and TVs, a longtime goal of leaders in both industries. Microsoft and other computing powerhouses have been actively involved in fighting the adoption of an interlaced scanning standard by which TVs transmit every other line of information in each of two passes. PCs, however, use what's known as progressive scanning technology. The Advanced Television Systems Committee (ATSC) originally proposed an interlaced digital TV standard, which would not have worked well on the PC.

Apple and several other computer makers say that the killer app for HDTV is the ability to concurrently browse high-resolution, large-aspect-ratio Web pages and receive equally impressive digital TV broadcasts. The marriage of digital broadcasts with personal computers has companies—including Apple and Microsoft—focusing on new computing applications, such as those designed for recording and editing digital video.

The long-awaited ATSC agreement was reached in late November, with an approved

video format to include both progressive and interlaced scanning, which makes the general format both TV- and PC-friendly. But the standards agreement is wide open on acceptable digital TV formats, which means that TV and PC manufacturers are in

frames per second with 1,280-by-720 resolution and 24 and 30 frames per second with 1,920-by-1,080 resolution. The standards agreement also includes 60-fps interlaced scanning with 1,920-by-1,080 resolution. The problem is that manufacturers are likely to produce PCs that will decode only one format, and other devices, such as set-top boxes, that will decode only some of the ATSC-specified formats. Prices for HDTV televisions are expected to start high, in the \$2,000 to \$3,000 range.

THE PLOT THICKENS

The transmission standard is only part of the HDTV story—spectrum allocation is another can of worms. Broadcasters assume they will be given spectrum for free, but critics argue that auctioning spectrum could bring in billions of dollars. If the FCC awards new spectrum for a digital TV standard, Congress can make spectrum auctions a part of federal budget negotiations. This means that digital TV could wait on hold during legislative and auction-related stalls. Spectrum now used by analog broadcasters is worth billions of dollars, and auctions over new spectrum allocations would also involve big sums. The Clinton administration's budget, in fact, focuses on spectrum auctions.

All this potential confusion has some analysts saying that the HDTV era has yet to arrive, and that the transition from analog to digital broadcasts will actually take 10 to 15 years—maybe even longer. Today's televisions may not be as high-tech as possible, but they're completely standardized and inexpensive. Dale Cripps, publisher of the *HDTV Newsletter*, is quick to point out that even rapidly accepted technologies can take a long time to realize truly widespread adoption, for which HDTV backers have hoped.

Cripps notes that AT&T is fond of telling listeners that billions of people have never placed or received a single telephone call. Cripps, an ardent backer of HDTV, also adds, "I don't think in my lifetime, or in the lifetime of anyone who is alive today, will we see HDTV more than just beginning to be the mass medium."—*Sebastian Rupley*



many cases likely to come up with incompatible devices. Enough variables exist in the ATSC agreement to make other historically hair-raising platform incompatibilities—such as beta versus VHS VCRs and PC versus Macintosh software—look like child's play.

The approved progressive scanning specifications for digital TV are 24, 30, and 60

Peppery Ads Flavor the Web

Net advertisers play the game.

Ads on Web pages have become as ubiquitous as their television counterparts. And with the advent of Java, many of these Web ads move, flash, and shuffle an in-your-face virtual dance. Most Web surfers find the ads a justifiable nuisance—annoying but tolerable, since they pay the bills. But many advertisers and content providers are striving to create ads that not only build mindshare but also provide a value-added way for readers to remember their products.

Hewlett-Packard's new ad is a prime example of an ad that entertains as it sells. The ad features a playable version of the classic Pong

video game. By moving your mouse, you can compete against the computer. The game keeps score and gets faster or slower depending on the location of your paddle, just as in the original. The main difference is the strategically placed HP logo that sits in the middle of the playing field.

DO YOU KNOW JACK?

Berkeley Systems blends a Web game show with TV-like commercials.

Berkeley Systems has also devised a smart new advertising model. The company has ported its wildly popular You Don't Know Jack PC party game to the Web. Two-parts quiz show and one-part sarcastic voice-over, the Web version is as fast and fun as the standalone game. Full-motion ads that could double as television commercials pop up between rounds. The ads are engaging, memorable, and funky, and they function as an integral part of the game. If you were to lose the ads, you would also lose part of the game's flavor—great news for the ten current advertisers on the site.

The evolution of Web advertising is a welcome change for everyone involved. It's a win-win-win situation for advertisers, content providers, and Internet users. Making ads fun may also lure many noncomputer advertisers to the Web and create loyal consumers. As Kate Delhagen, analyst at market-research firm Forrester Research, explained in a report entitled "Young Adults Get the Net," "capturing the attentions and budgets of 5 million young adults can give online retailers and entrepreneurs a solid revenue stream. Merchants that keep the attention and loyalty of young adults as they grow to become 10 million strong can be assured of a steady business."—Karen Bannan



Benchmark Tests++

IT'S BEEN A WHILE SINCE OUR LAST comparative review of C++ compilers, and a lot has happened in the world of computer languages in the interim. So much has changed, in fact, that we realized we needed new compiler performance tests for our applications development story ("C++: Adapted for RAD"; in this issue). After discussions with vendors and independent developers, we decided to benchmark-test the compilers using C++ features rather than relying on C code.

Many C++ compiler reviews rely heavily on C code for testing, but writing Windows applications in C has simply become too difficult. The Windows environment is set up for developers to use C++ within a powerful application framework, such as the Microsoft Foundation Classes (MFC), which in some ways has become the new Windows API. Richard Dragan, our top programmer here at PC Magazine Labs, developed a test engine for C++ code written as a set of C++ classes that lets us plug in new tests without changing the engine.

TEMPLATE EVOLUTION

Ironically, templates, one of the great advances in C++ in recent years, represents something of a retreat from the object-oriented features that make the C++ language different from C. Templates are special kinds of macros that let you change the characteristics of classes and functions, such as their types and parameters, based on well-known and well-tested designs. Templates work their magic at compile-time rather than at runtime, as most modifications in classes do.

A standard C++ library built largely around templates has started to evolve. The "Standard Library," as it's known,

contains the Standard Template Library plus certain string and complex number classes. We relied heavily on the Standard Library in our benchmark tests, as well as on other C++ features. Since there are many languages to choose from for Windows applications development, we focused on what makes C++ different. Java, for instance, will never have templates, because it has no preprocessor.

The Labs staff entered this compiler comparison expecting the relative performance of the products to be on a par with past reviews, but our tests uncovered some differences. Powersoft (formerly Watcom) has always been known for top performance, and its Optima++ performed well on our tests. But Powersoft conceded that its product has problems with templates. Microsoft,

meanwhile, has improved its optimization of C++ code. (See the sidebar "How We Tested" in "C++: Adapted for RAD" for details.)

Performance was only one criterion we

considered in our evaluation.

The other big C++ story this year is components: The industry is moving to a more Visual Basic-like approach for C++. Optima++ is a great example. But this move doesn't come trouble-free. In order to support component-based programs, some of the compilers take liberties with the naming of certain routines, a practice that makes it difficult to port old code. We ran into just such a problem with our benchmark tests but were able to work around them after consulting Powersoft.

We're convinced that our focus on C++ language features contributed to meaningful results in this issue's compiler story. The tests not only identified performance strengths and weaknesses in the products, but also uncovered a bug in one of the products.—Larry Seltzer

C++: Plus

Based on open standards.
Good execution speed
Templates
Multiple inheritance.

C++: Minus

Way too complex.
Platform-specific apps.
Steep learning curve.
Multiple inheritance.

Is It Mine Online?

International panel irons out Internet policy.

How long will it be before full-length feature films are instantaneously and freely downloadable from the Web? What about software? Books? Music? When these products—all of which have copyright protection in their native formats—are being copied relentlessly online, will their creators simply throw up their hands and stop creating?

Such hard-to-answer questions were on the agenda as 160 nations sent representatives to December's 18-day World Intellectual Property Organization (WIPO) conference in Geneva, Switzerland. When delegates sat down to wrestle with ways to protect literature, art, phonograms (better known as music), and databases, the head U.S. delegate, Commissioner of Patents and Trademarks Bruce Lehman, was prepared to support a draft treaty that many academics and media experts feel is too strident in upholding copyrights online and that could restrict fair use and potentially hurt the evolution of the Internet.

But in an interview with *The New York Times* Lehman wasn't having any of it. "That's absolute garbage," he was quoted as saying. "We are protecting people against the theft of their intellectual property, not trying to stop fair use. If you're going to have people making large-scale investments in this new digital environment, they have to have some sense of security that they are going to be protected and make money on it."

The WIPO members plan to hammer out additional protocols to the Berne Convention for the Protection of Literary and Artistic Works, an umbrella treaty for the international understanding of copyright protection dating back to 1886. But that was before questions about Internet liability hit the radar screen. For instance, if a Web site contains a link to another site that's a hotbed of software piracy, who's committed copyright violations?

The effort to establish rules of conduct for

electronic copyright protection and infringement liability are under way on the international front, but issues remain unresolved on a national level. Last year, the House judiciary committee tried to iron out whether or not service providers should be liable for copyright infringement, but the so-called Lehman Bill never made it to the floor of Congress.

"Berne is critical for moving intellectual property into the digital age," says attorney Jack Krumholz, Microsoft's federal-government-affairs manager. He contends that because the issue of ISP liability stems from

the theory of "contributory infringement—a legal doctrine in only a handful of countries—it's really a 'U.S.-centric issue that should be dealt with in the U.S. Congress.'"

—Don Willmott and Carol Levin



JAKE KIRCHNER

AMD: Big Talk, Bigger Dreams

The history of the microprocessor is one of big dreams for small products. From the creation, 25 years ago, of the first microprocessor (the Intel 4004), the personal computing industry has been paced by those driven to cram more and more power into an increasingly smaller space. The engineers who have left their footprints in silicon these past two decades will be counted as technology giants for generations to come.

Today, no one in the chip business talks bigger or dreams bigger than Jerry Sanders, chairman and CEO of Advanced Micro Devices (AMD). Sanders is absolutely convinced that his company is about to take a huge chunk of the microprocessor market away from Intel, which has held an all-but-unchallenged monopoly in the PC world for more than a decade.

For the first time in 20 years, Sanders will tell you, Intel is about to have a direct, head-to-head competitor for its primary line of business—the Intel Pentium with MMX and the Pentium Pro processors. Of course, Sanders is referring to the AMD K6 chip, which, in the months ahead, he expects to see powering the mainstream PCs of at least half the leading U.S. vendors.

The K6 is the first fruit of AMD's surprise acquisition of NexGen a year ago. The resolution of ten years of legal wrangling with Intel over the rights to various chip patents left AMD with the rights to current Intel designs, including MMX technology, which AMD is bringing to market effectively coincident with the arrival of the Intel Pentium with MMX. In fact, because much of the MMX chip's performance boost results from the increased cache size of the MMX processors, the K6, with a 64K cache—twice the size of a compara-



ble Intel chip's cache—is grabbing early bragging rights in the enhanced-multimedia market.

Sanders is quite clear in his claims that the K6 chip—hitting the streets at 200 MHz—will at least equal Intel's offering in power yet be introduced at a price that's 25 percent less than the Intel Pentium 200 with MMX's. Sanders, not one to give a yes or no answer when a more colorful reply might muscle its way to the top of a news story, responded to the question of whether his company will have a laptop MMX processor by the end of 1997 by declaring, "If it [doesn't], I will personally immolate myself in any place you choose in Santa Clara."

Sanders knows AMD must overcome the bruises its reputation suffered from the lengthy delays of the current-generation K5 processor. More important, AMD must face down years of "Intel Inside" promotions and Intel's control of a great deal of PC makers' ad dollars. But Sanders argues that the Intel hegemony is primarily a U.S. phenomenon, and he notes that two-thirds of all PCs are sold outside the U.S. AMD's strength in Asia and Europe—especially in Germany—will help his company capture almost 20 percent of the world market for microprocessors, claims Sanders.

Obviously, there's a long way between here and there, and we won't be able to judge AMD's outlook until we get a much closer look at the K6 in PC Magazine Labs (stay tuned for those results), but on paper, Sanders' company has the design, the fabrication capacity, and the market relationships to make a real difference.

And who knows? Perhaps there are still great legends to be added to the history of microprocessors.



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DESKTOP PCs

MMX Marks the Spot: A Boost for Home PCs

The Pentium processor with MMX technology represents the first major modification of Intel's x86 architecture in almost 11 years. In this issue's cover story—"MMX Extends the Desktop"—we review the first dozen systems to benefit from the MMX instruction set's boost to multimedia performance. In addition to these 12 machines, several more MMX models will be available early this year, including systems from Compaq Computer Corp., Dell Computer Corp., IBM, and ProGen Systems.

Aimed at consumers is Compaq's **Presario 4784** (800-345-1518, www.compaq.com). The \$2,700 system is based on a 200-MHz MMX processor, 32MB of synchronous DRAM, a 4.3GB hard disk, 16-bit wavetable sound, a 14-inch monitor, and a MIDI/game port. The integrated S3 ViRGE 3D graphics subsystem uses 2MB of EDO memory. The variable-speed CD-ROM drive, referred to as a 16X Max drive, can move data at from 1.2 to 2.4 Mbps. The Presario 4784 also includes a 33.6-/14.4-Kbps DSVD Talk and Send modem (upgradable to 56 Kbps) and a pair of JBL Pro Premium stereo speakers.

The system features the current Presario case design, which is immediately recognizable

RECAP For more details on MMX systems, see our roundup of desktop PCs in this issue. The Editors' Choice winners in our December 17, 1996, story on home PCs, "High Style, High Speed," were the

- Toshiba Infinia 7200 (high-end system)
- Acer Aspire Personal Solution (midrange system).

The Infinia 7200 also garnered a *PC Magazine* 1996 Technical Excellence award among desktop systems (December 17, 1996).



HOME COMPANION: The Presario 4784 brings MMX to the consumer market at an affordable price.

thanks to the panel of Easy Access Buttons that sits on top of its chassis. The panel provides one-touch control of the CD player, the system's sleep features, and Compaq's SmartQ front end, which provides extensive technical support information and access to multiple user profiles. The panel even notifies you when a message or fax has arrived.

With this hardware package, Compaq ships an eclectic software bundle that includes a Phone Center (which integrates an Address Book, Speaker Phone, voice mail, and fax features in a simple window), Microsoft Works, Quicken SE, and CorelDraw!. The company also includes two MMX-optimized software titles: DK Multimedia's The Ultimate Human Body and UbiSoft Entertainment's POD. Compaq's warranty includes a year of parts and labor, and 90 days of on-site service.

Dell (800-388-8542, www.dell.com) was the only vendor to provide two systems for our cover story, but it also has a third

MMX desktop worthy of mention. The OptiPlex GS 200 represents the low end of the company's corporate line, while the OptiPlex GXi is aimed at the mainstream corporate desktop.

The \$2,758 MMX version of the

OptiPlex GXi has an adaptable chassis that can lie flat like a desktop unit or turn on its side to stand upright like a mini-tower. The system includes 32MB of EDO RAM with ECC, a 2GB hard disk, 256K of external cache, and an 8X CD-ROM drive. The Dell motherboard integrates an S3 Trio 64 chip with 2MB of EDO video memory;

you can upgrade to a Number Nine Imagine Series II with 4MB of VDRAM for \$599. The system has an integrated 16-bit Creative Labs sound subsystem and Altec Lansing speakers.

The \$2,758 price tag includes a 17-inch monitor and a built-in 10/100 Ethernet chip set from 3Com for networked corporate users. Dell includes a three-year warranty on parts and labor as well as a year of on-site service.

Though we review an IBM corporate system in our cover story, we were not able to get an Aptiva home system in time for testing. But the IBM Consumer Division (800-426-7235, ext.

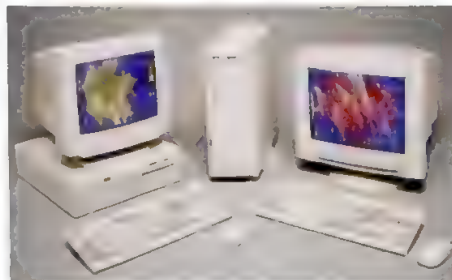
4340, www.pc.ibm.com/aptiva) has two MMX home systems. The 166-MHz **Aptiva S80** and the 200-MHz **Aptiva S90** will probably retail in the \$3,200 to \$3,600 range. Differing only in processor clock speed, these systems include 32MB of EDO DRAM memory, a 3.2GB hard disk, 256K of external cache, and an ATI 3D Rage graphics subsystem with 2MB of EDO DRAM. With a charcoal-color main chassis designed to be placed out of sight beneath your desk, the Media Console fits below the monitor and holds an 8X CD-ROM drive and a standard 3.5-inch floppy disk drive.

The systems include multimedia 15-inch Aptiva monitors, which integrate two speakers; with optional \$99 subwoofers, the systems produce some of the best sound in the home PC market. Both systems ship with 33.6-Kbps modems and three MMX-optimized software packages: the Ultimate Human Body 2, POD, and Davidson & Associates' The Third Dimension. Like the Pentium Classic Aptivas, the S80 and the S90 also come with such home titles as Lotus SmartSuite, Quicken SE, and Microsoft Encarta.

The **Atlas MMX 200** is ProGen Systems' (800-848-1353, www.progen.com) entry into the MMX Pentium arena. With prices starting at \$2,299, this system's Intel motherboard integrates 16MB of EDO RAM, a 2.5GB hard disk, a 12X CD-ROM drive, 256K of external cache, an S3 ViRGE graphics engine with 2MB of EDO DRAM, a 33.6-Kbps modem, and Yamaha wavetable audio. Included are two 80-

watt PMPO amplified speakers, a subwoofer, and a 15-inch monitor.

ProGen's parts-and-labor warranty extends for an impressive three years and includes a year of on-site service.—Cade Metz



IN BUSINESS: Dell's OptiPlex GXi 200 lies flat as a desktop unit or on its side as a mini-tower.



The Boss.

If you're very lucky, there will be a few moments in your career when the people who really matter think you're an absolute genius. And if you're about to upgrade to computers with Pentium® Pro processors and convert your company to Windows NT® the next such moment could be arriving sooner than you expected. That is, if you make the extraordinarily brilliant, wunderkind-like decision to choose the AST® Bravo MS-T Pro.

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The Bravo MS-T Pro comes with amazing technology like the Matrox Millennium graphics card. And with the Pentium® Pro processor, it's a breeze to run popular business programs—in 16 or 32 bit format—up to 64% faster than you run them now. To enhance productivity even more, there's AST-IntraAccess™ complete Intranet/Internet software.

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The guy who brought in the \$10,000,000 client.

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180 and 200 MHz Pentium® Pro processors, Matrox Millennium graphics
with 2 MB WRAM upgradeable to 8MB, 8X CD-ROM,
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TAX SOFTWARE

Relief for the Taxed

To help relieve your income tax-filing burden, tax software vendors are polishing their wares. For those of you who want to get a head start on your taxes this year, here's a preview of your tax software options. A full feature on tax software will appear in our next issue.

Intuit's perennially popular \$34.95 **TurboTax**, which runs on Microsoft Windows 3.1 or Windows 95, includes features that focus on thoroughness and efficiency for filing federal taxes; you'll also need the corresponding \$24.95 **TurboTax State** unless you earned income in one of the five states that have no state income tax. Intuit (800-446-8848, www.intuit.com) has improved both TurboTax's Smart Final Review, which checks your return for mistakes, and its Refund Monitor, which shows the amount of refund or tax due no matter which part of your return you're working on.

New, time-saving features include Easy Step Interview, Transfer Report, and Forms Editing. The \$49.95 **TurboTax Deluxe** includes more multimedia advice and Tax Planner, a new tool that helps you plan ahead for next year's taxes.

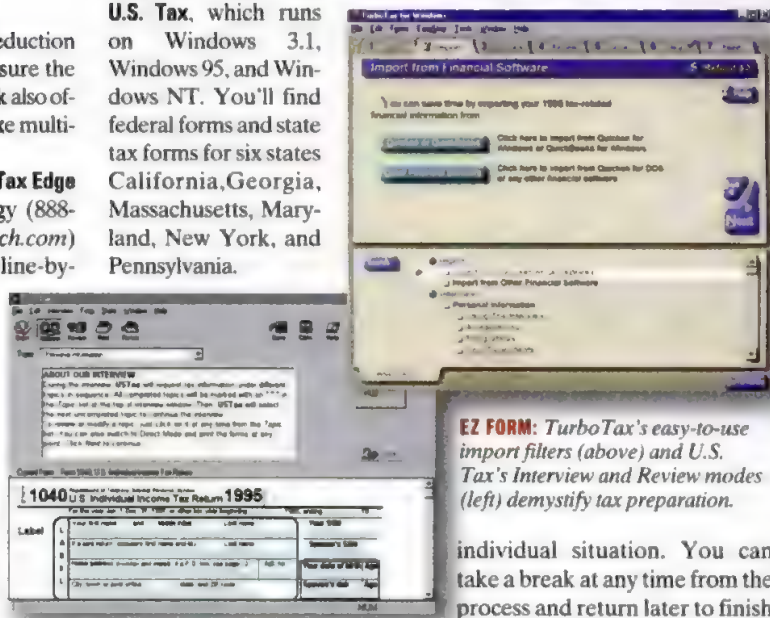
Kiplinger TaxCut, a \$19.95 cross-platform package (Windows 3.1, Windows 95, or Macintosh) from Block Financial Co. (800-235-4060, www.conductor.com), also focuses on accurate information retrieval for filing federal taxes. An upgrade (for 23 states) to the state tax product will be available in February for \$24.95. Kiplinger now includes a "getting to know you" feature, which makes sure that you've supplied all the information that's applicable to your individual tax situation. Two other new features,

Audit Buster and Deduction Sleuth, also attempt to insure the most accurate return. Block also offers a cross-platform deluxe multimedia edition for \$35.

The \$19 **1996 Personal Tax Edge** from Parsons Technology (888-883-0791, www.parsonstech.com) now comes with detailed line-by-line help that enhances the interview process, on-screen form scalability, and password protection for data files. A new interface lets you work on Personal Tax Edge and the \$19 **Parson's State Tax Edge** (for 42 states) at the same time, so you don't have to jump between programs; the state modules load directly into the federal program. Both programs run on DOS, Microsoft Windows 3.1, and Windows 95.

Total Peripherals (800-613-5157, www.totaltax.com) has introduced a newcomer in the tax software field, the \$19.95 **U.S. Tax**, which runs on Windows 3.1, Windows 95, and Windows NT. You'll find federal forms and state tax forms for six states: California, Georgia, Massachusetts, Maryland, New York, and Pennsylvania.

you answer a series of questions about your financial situation; the program skips those queries that are not relevant to your



EZ FORM: TurboTax's easy-to-use import filters (above) and U.S. Tax's Interview and Review modes (left) demystify tax preparation.

individual situation. You can take a break at any time from the process and return later to finish up. And U.S. Tax's Review mode scans your completed forms for missing, inconsistent, and inaccurate information.—Yvonne Koulouthros

SMALL-BUSINESS ACCOUNTING

Accounting 101

The accounting needs of a small business differ from those of a Fortune 500 company. The latest small-business accounting packages address these needs with enhanced ease of use, better customization, increased business management, and Internet functionality.

QuickBooks 5.0, a \$99 package from Intuit (800-446-8848, www.intuit.com) that runs on Microsoft Windows 3.1 and Windows 95 is equipped with such customizable features as drag-and-drop functionality, resizable fields, Show Me tools, individual font control, word wrap, and multiple forms and invoices. These features are a useful addition to the standard accounting modules—inventory, payroll, time tracking, and audit trail. As an added convenience, QuickBooks has a link to Intuit's TurboTax.

The first Windows release of **Big Business**, from Big Software (800-711-7458, www.bigsoftware.com), targets small and growing businesses. This \$199 package for Windows 95 and Windows NT has four components: accounting, sales and inventory management, sales automation, and a marketing database.

Big Business comes with such accounting staples as accounts payable and accounts receivable; Internet features include catalog publishing and electronic commerce. You'll also find complete memorization and recall, batch processing of billings, a fully searchable database, and automatic purchase orders.

The \$69.95 **One-Write Plus Accounting** comes from One-Write Plus, a division of ADP (800-649-1720). Organized entirely around accounting tasks, this package now includes unlimited job and project tracking, inventory tracking, improved password protection, and plain-paper forms printing. The program, which runs on Windows 3.1 and Windows 95, has also retained its double-entry accounting approach. By early spring, electronic banking and checking will be bundled with the software, along with Peachtree Business Internet Suite from Peachtree Software, another ADP company.—YK



CLOSING THE BOOKS: QuickBooks's Navigator makes it easy to jump from module to module.

Trends Peripherals

GRAPHICS PRINTERS

If It Looks like a Wide-Format Printer...

Call your device a plotter and the CAD contingent will come. Call it a wide-format printer and you'll lure graphics artists, commercial design departments, and pay-for-print shops. Traditionally that's been the case, with ink jet plotters and large-format printers filling discrete niches based not so much on hardware differences but on marketing strategies. Increasing growth in the large-color-print market (posters, banners, bus placards, and trade-show signs) has given rise to a reexamination of the value of the plotter tag.

For its part, Hewlett-Packard (800-851-1170, www.hp.com) has declared the ink jet plotter/

printer distinction to be nonexistent, as can be seen by the company's large-format printer, the **DesignJet 750C Plus Printer**. The new model, priced from \$6,495 to \$7,495 (depending on options and accessories), can print on media up to 36 inches wide, and it adds some CAD enhancements that its forerunner—the DesignJet 750 Plotter—lacked, such as 600-dpi sharp line mode. It also uses HP's new Windows auto-scale driver, called Zoom-Smart, which lets you scale up an Excel spreadsheet or a bulleted Word list without the use of expensive third-party software. The unit is fast, producing monochrome or 300-dpi color,



BLUEPRINT: Calcomp's SummaCAD series is for CAD and engineering professionals.

draft prints in under 4 minutes, and best-quality four-color prints in 9 minutes.

As in the past, Calcomp (714-821-2000, www.calcomp.com) is targeting its two new ink jet plotters squarely at the CAD and engineering folks. The **SummaCAD 5624S** and **SummaCAD 5636S** cost \$2,495 and \$2,995, respectively. Each combines 360-dpi color and 720-dpi monochrome capabilities in a single unit that

uses snap-in, interchangeable ink cartridges. Output can be cut-sheet or roll-fed media in a wide variety of types, including color bond paper, vellum, and matte film.

With the \$11,995 **Phaser 600**, Tektronix (800-835-9433, www.tektronix.com) has thrown its hat squarely into the wide-format arena. Able to make 300-dpi prints at up to 34 inches wide, the Phaser 600 uses a solid-ink process that produces waterproof, smudgeproof prints on any paper stock. This method is slower than ink jet printers, though; it takes 12 minutes to print a four-color image in standard mode and 25 minutes in enhanced mode. The Phaser 600 lets you choose either manual or roll media-feed, includes an auto-cutter and super capacity solid-ink reservoirs, hot-swappable and ink cartridges.—Toni Kistner

INPUT DEVICES

Keying for All Kinds

There's one thing you can count on: Someone's always building a better—or at least different—keyboard.

On the untethered front, Sejin America (888-373-3273, www.sejin.com) has introduced the **\$99 SPR-8695WT**, a wireless plug-and-play keyboard for Microsoft Windows 95. This compact unit lets you wander up to 20

Model RT-2200W (800-662-8321, www.nmbtech.com). The Windows 95-compatible 104-key layout is 25 percent smaller than that of standard keyboards

its **QWERTY/Dvorak (QD)**, a convertible keyboard that allows you to toggle between a conventional keyboard layout and Kinesis's ergonomic Dvorak configuration. The QD carries a \$265 price tag (\$395 for the programmable professional version). Converts to the Dvorak layout will find that the design lets them master the keyboard at their own pace.

Another ergonomic keyboard offering comes from Acer America (800-845-2237, www.acer.com). Its uniquely

CD PRINTERS

Print on Your Platters



You've bought a CD-R drive, but you still need a CD printer to make your CDs like the professionals'. Marking CDs with a felt-tip pen looks amateurish and might damage the data and your drive.

Farar Electronic's \$1295

**Sony
Picture Quality**

Super Fine Pitch™
Trinitron™ CRT

Multiscan®
Technology

Accurate Focus
Corner to Corner

Sony Engineering

Vertically Flat Screen

Higher Resolutions
& Refresh Rates

Digital On-Screen
Controls

Sony Advantages

Broad Family
of Displays

National Service
and Support

Windows® 95
AAIUQOMZ 3D



Trinitron

Multiscan 300sf



SONY

Display your productivity

Displays by Sony. Accurate focus corner to corner.
A cleaner, crisper picture. Vivid, precise color.
Your display is where your work gets done.
Don't you deserve a Sony?

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INTERNET CHAT SOFTWARE

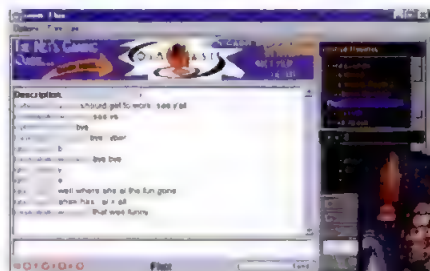
Chatting the Web Away

Chat sessions are a great way to add interactivity to your Web site because they give users an open forum for discussing shared interests. These three chat room packages offer different paths for enabling real-time user interaction while at the same time providing less cumbersome server maintenance.

The Palace, Version 2 (503-626-7575, www.thepalace.com), creates a unique 2-D virtual world for designing, running, and using graphical chat rooms. Users can download the viewer and get unlimited free access to all of The Palace's chat sites, including Capitol Records, HotWired's Malice Palace, and the House of Blues. A fully customizable version of The Palace costs \$25.

Chat server administrators can use The Palace to host conferences or virtual meetings of as many as 25 people. The Palace functions as a TCP/IP-based

software interface for designing your own chat room, which with at least a 14.4-Kbps modem can run on a 486 or faster PC. Designing your own chat room re-



quires a flat fee of \$50. If you want to set up a chat room for from 100 to 2,500 users, registration and software fees range anywhere from \$1,000 to \$10,000. The Palace's server allows designers to embed Shock-wave animation sequences within their chat sites. Both the client and the server package are now available on a \$50 CD-ROM.

Rooms 3.0 is ichtat's latest threaded-discussion server application (512-349-0339, www.ichtat.com). Rooms functions as the core element of ichtat's larger Community System, which includes iPage, a paging application that allows you to locate and contact anyone on the Net who has iPage running, and iThread,

TALK TO ME: *talk.com* (left) and *The Palace* (below) can turn your Web site into a silicon salon.



which creates electronic discussion-group forums with comments and responses sorted by subject. Although iPage and iThread can operate as stand-

alone products, they are designed to integrate with live interactive chat servers running Rooms.

Chat sites using ichtat's technology include the EarthLink Network (www.earthlink.com) and The Outer Limits (www.theouterlimits.com).

Another notable newcomer is HotWired's **talk.com**. Part of the larger HotWired community, this free chat site (www.talk.com) aims to reproduce on the Web (and as a Castanet channel) the same easy-to-use chat room experience of such proprietary services as America Online. Talk.com is entirely Java-based and features the ability to choose multiple nicknames, create user-designed discussion groups around selected topics, and converse privately one-on-one. Although all the chat rooms are totally uncensored, users can squelch bothersome chatmates at their own discretion.

HotWired plans to license talk.com's chat technology to other commercial Web sites within the next few months. —Josh Levy

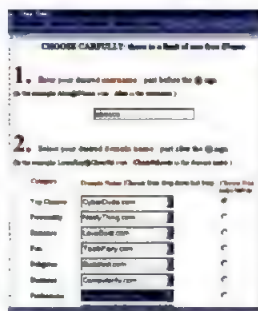
E-MAIL

Never Change Your E-Mail Address Again

If you've ever had to change Internet service providers or e-mail accounts, then you know what an inconvenience it can be to notify all your correspondents of an e-mail address change. To alleviate this problem, three companies

are now offering users single lifetime, e-mail addresses.

Bigfoot (www.bigfoot.com), an online e-mail directory, provides e-mail free for life to anyone registered with its directory, which is also free. Give Bigfoot a forwarding address for your mail and you're all set. Bigfoot assigns you an address to use for all your e-mail (username@bigfoot.com). And whenever you move or change ISPs, you simply notify Bigfoot of your new e-mail address.



VANITY URL: Pick a personalized address with iName.

HotMail (www.hotmail.com) has a similar free service. HotMail is currently partnered with the Four11 directory service, but when you sign

up for your HotMail address you choose whether to have your information exported to the Four11 database.

Putting an interesting twist on this idea is **iName** (www.iname.com), which lets you choose your permanent e-mail address from a selection of such vanity domain

names as catlover.com. Categories include business, romance, and profession. iName is free for the time being, but it has plans to become a paid subscription service by providing such options as the ability to forward mail to multiple e-mail addresses. —Andrew Boscardin

COOL WEB SITE

www.towerrecords.com



TOWER ONLINE: Entering the world of Internet commerce is @Tower, the online version of the music store chain, Tower Records. First-time visitors to the Web site (www.towerrecords.com) enter such registration information as preferred music genre and favorite artist. On subsequent visits, @Tower runs a search using that information and finds titles you may be interested in, providing a custom starting point for your shopping. —AB

RECAP

For a full review of HotMail and other free e-mail services, see *First Looks*, September 24, 1996. For a complete roundup of e-mail software, see "E-Mail: Building the Perfect In-Box," October 8, 1996. Our Editors' Choices from that story were CommTouch Software's Pronto 96 among standalone e-mail clients, and Microsoft Internet Mail and Netscape Navigator Gold 3.0 (Netscape Mail) for integrated e-mail front ends.



The Biggest News in Notebooks is Available Today

13.3" DISPLAY

13.3" DISPLAY	1024x768 @ 65,000 Colors
2MB Video RAM	Outstanding Graphic Performance
Wave Table Synthesis	"Real Instrument" Audio Performance
10X CD ROM	Smart Bay for Dual Battery, CD or Floppy
Video Capture	Display TV and Live Video on Your Notebook
150MHz	Intel Pentium® Processor
2.1GB HDD	For Expanded Storage
Zoom Video Support	On PC Card Type III Slot
16MB RAM	EDO RAM Expandable to 80MB
Lithium Ion Battery	With Dual Battery Support
Internal Modem	33.6 Internal FAX/Modem
Fast SIR Interface	Fast Wireless Connection
Lightweight	Only 6.7 lbs.

The News couldn't be better. We've taken our award winning TravelPro Notebooks to a whole new dimension. Our New 13.3" Active Matrix Display is powered by an advanced graphics system and 10X CD-ROM that produces the most incredible visuals ever seen on a portable computer. The system is driven by Intel's fastest mobile CPU and is loaded with features like the built in 33.6 modem, wave table audio and video capture system that delivers live video or television right on the notebook display. Combine all this with a price of only \$4,695.00, and you'll see why compared to the TravelPro 2000CX, the rest of the competition just doesn't measure up.



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The 13.3" TravelPro 2000 for only

\$4695*

TravelPro Price & Feature Selector

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Model #	Price	Processor	RAM	Model #	Price	Processor	RAM
2000C	2,399	100MHz	16MB	2000	2,999	150MHz	16MB
2000CX	2,599	100MHz	16MB	2000S	3,199	150MHz	16MB
2000D	2,799	100MHz	16MB	2000L	3,399	150MHz	16MB
2000E	2,999	100MHz	16MB	2000H	3,599	150MHz	16MB
2000F	3,199	100MHz	16MB	2000M	3,799	150MHz	16MB
2000G	3,399	100MHz	16MB	2000N	3,999	150MHz	16MB
2000I	3,599	100MHz	16MB	2000O	4,199	150MHz	16MB
2000J	3,799	100MHz	16MB	2000P	4,399	150MHz	16MB
2000K	3,999	100MHz	16MB	2000Q	4,599	150MHz	16MB
2000L	4,199	100MHz	16MB	2000R	4,799	150MHz	16MB
2000M	4,399	100MHz	16MB	2000T	5,199	150MHz	16MB
2000N	4,599	100MHz	16MB	2000U	5,399	150MHz	16MB
2000O	4,799	100MHz	16MB	2000V	5,599	150MHz	16MB
2000P	4,999	100MHz	16MB	2000W	5,799	150MHz	16MB
2000Q	5,199	100MHz	16MB	2000X	5,999	150MHz	16MB
2000R	5,399	100MHz	16MB	2000Y	6,199	150MHz	16MB
2000S	5,599	100MHz	16MB	2000Z	6,399	150MHz	16MB
2000T	5,799	100MHz	16MB	2000AA	6,599	150MHz	16MB
2000U	5,999	100MHz	16MB	2000AB	6,799	150MHz	16MB
2000V	6,199	100MHz	16MB	2000AC	6,999	150MHz	16MB
2000W	6,399	100MHz	16MB	2000AD	7,199	150MHz	16MB
2000X	6,599	100MHz	16MB	2000AE	7,399	150MHz	16MB
2000Y	6,799	100MHz	16MB	2000AF	7,599	150MHz	16MB
2000Z	6,999	100MHz	16MB	2000AG	7,799	150MHz	16MB
2000AA	7,199	100MHz	16MB	2000AH	7,999	150MHz	16MB
2000AB	7,399	100MHz	16MB	2000AI	8,199	150MHz	16MB
2000AC	7,599	100MHz	16MB	2000AJ	8,399	150MHz	16MB
2000AD	7,799	100MHz	16MB	2000AK	8,599	150MHz	16MB
2000AE	7,999	100MHz	16MB	2000AL	8,799	150MHz	16MB
2000AF	8,199	100MHz	16MB	2000AM	8,999	150MHz	16MB
2000AG	8,399	100MHz	16MB	2000AN	9,199	150MHz	16MB
2000AH	8,599	100MHz	16MB	2000AO	9,399	150MHz	16MB
2000AI	8,799	100MHz	16MB	2000AP	9,599	150MHz	16MB
2000AJ	8,999	100MHz	16MB	2000AQ	9,799	150MHz	16MB
2000AK	9,199	100MHz	16MB	2000AR	9,999	150MHz	16MB
2000AL	9,399	100MHz	16MB	2000AS	10,199	150MHz	16MB
2000AM	9,599	100MHz	16MB	2000AT	10,399	150MHz	16MB
2000AN	9,799	100MHz	16MB	2000AU	10,599	150MHz	16MB
2000AO	9,999	100MHz	16MB	2000AV	10,799	150MHz	16MB
2000AP	10,199	100MHz	16MB	2000AW	10,999	150MHz	16MB
2000AQ	10,399	100MHz	16MB	2000AX	11,199	150MHz	16MB
2000AR	10,599	100MHz	16MB	2000AY	11,399	150MHz	16MB
2000AS	10,799	100MHz	16MB	2000AZ	11,599	150MHz	16MB
2000AT	10,999	100MHz	16MB	2000BA	11,799	150MHz	16MB
2000AU	11,199	100MHz	16MB	2000BB	11,999	150MHz	16MB
2000AV	11,399	100MHz	16MB	2000BC	12,199	150MHz	16MB
2000AW	11,599	100MHz	16MB	2000BD	12,399	150MHz	16MB
2000AX	11,799	100MHz	16MB	2000BE	12,599	150MHz	16MB
2000AY	11,999	100MHz	16MB	2000BF	12,799	150MHz	16MB
2000AZ	12,199	100MHz	16MB	2000BG	12,999	150MHz	16MB
2000BA	12,399	100MHz	16MB	2000BH	13,199	150MHz	16MB
2000BB	12,599	100MHz	16MB	2000BI	13,399	150MHz	16MB
2000BC	12,799	100MHz	16MB	2000BJ	13,599	150MHz	16MB
2000BD	12,999	100MHz	16MB	2000BK	13,799	150MHz	16MB
2000BE	13,199	100MHz	16MB	2000BL	13,999	150MHz	16MB
2000BF	13,399	100MHz	16MB	2000BM	14,199	150MHz	16MB
2000BG	13,599	100MHz	16MB	2000BN	14,399	150MHz	16MB
2000BH	13,799	100MHz	16MB	2000BO	14,599	150MHz	16MB
2000BI	13,999	100MHz	16MB	2000BP	14,799	150MHz	16MB
2000BJ	14,199	100MHz	16MB	2000BQ	14,999	150MHz	16MB
2000BK	14,399	100MHz	16MB	2000BR	15,199	150MHz	16MB
2000BL	14,599	100MHz	16MB	2000BS	15,399	150MHz	16MB
2000BM	14,799	100MHz	16MB	2000BT	15,599	150MHz	16MB
2000BN	14,999	100MHz	16MB	2000BU	15,799	150MHz	16MB
2000BO	15,199	100MHz	16MB	2000BV	15,999	150MHz	16MB
2000BP	15,399	100MHz	16MB	2000BW	16,199	150MHz	16MB
2000BQ	15,599	100MHz	16MB	2000BX	16,399	150MHz	16MB
2000BR	15,799	100MHz	16MB	2000BY	16,599	150MHz	16MB
2000BS	15,999	100MHz	16MB	2000BZ	16,799	150MHz	16MB
2000BT	16,199	100MHz	16MB	2000CA	16,999	150MHz	16MB
2000BU	16,399	100MHz	16MB	2000CB	17,199	150MHz	16MB
2000BV	16,599	100MHz	16MB	2000CC	17,399	150MHz	16MB
2000BW	16,799	100MHz	16MB	2000CD	17,599	150MHz	16MB
2000BX	16,999	100MHz	16MB	2000CE	17,799	150MHz	16MB
2000BY	17,199	100MHz	16MB	2000CF	17,999	150MHz	16MB
2000BZ	17,399	100MHz	16MB	2000CG	18,199	150MHz	16MB
2000CA	17,599	100MHz	16MB	2000CH	18,399	150MHz	16MB
2000CB	17,799	100MHz	16MB	2000CI	18,599	150MHz	16MB
2000CC	17,999	100MHz	16MB	2000CJ	18,799	150MHz	16MB
2000CD	18,199	100MHz	16MB	2000CK	18,999	150MHz	16MB
2000CE	18,399	100MHz	16MB	2000CL	19,199	150MHz	16MB
2000CF	18,599	100MHz	16MB	2000CM	19,399	150MHz	16MB
2000CG	18,799	100MHz	16MB	2000CN	19,599	150MHz	16MB
2000CH	18,999	100MHz	16MB	2000CO	19,799	150MHz	16MB
2000CI	19,199	100MHz	16MB	2000CP	19,999	150MHz	16MB
2000CJ	19,399	100MHz	16MB	2000CQ	20,199	150MHz	16MB
2000CK	19,599	100MHz	16MB	2000CR	20,399	150MHz	16MB
2000CL	19,799	100MHz	16MB	2000CS	20,599	150MHz	16MB
2000CM	19,999	100MHz	16MB	2000CT	20,799	150MHz	16MB
2000CN	20,199	100MHz	16MB	2000CU	20,999	150MHz	16MB
2000CO	20,399	100MHz	16MB	2000CV	21,199	150MHz	16MB
2000CP	20,599	100MHz	16MB	2000CW	21,399	150MHz	16MB
2000CQ	20,799	100MHz	16MB	2000CX	21,599	150MHz	16MB
2000CR	20,999	100MHz	16MB	2000CY	21,799	150MHz	16MB
2000CS	21,199	100MHz	16MB	2000CZ	21,999	150MHz	16MB
2000CT	21,399	100MHz	16MB	2000DA	22,199	150MHz	16MB
2000CU	21,599	100MHz	16MB	2000DB	22,399	150MHz	16MB
2000CV	21,799	100MHz	16MB	2000DC	22,599	150MHz	16MB
2000CW	21,999	100MHz	16MB	2000DD	22,799	150MHz	16MB
2000CX	22,199	100MHz	16MB	2000DE	22,999	150MHz	16MB
2000CY	22,399	100MHz	16MB	2000DF	23,199	150MHz	16MB
2000CZ	22,599	100MHz	16MB	2000DG	23,399	150MHz	16MB
2000DA	22,799	100MHz	16MB	2000DH	23,599	150MHz	16MB
2000DB	22,999	100MHz	16MB	2000DI	23,799	150MHz	16MB
2000DC	23,199	100MHz	16MB	2000DJ	23,999	150MHz	16MB
2000DD	23,399	100MHz	16MB	2000DK	24,199	150MHz	16MB
2000DE	23,599	100MHz	16MB	2000DL	24,399	150MHz	16MB
2000DF	23,799	100MHz	16MB	2000DM	24,599	150MHz	16MB
2000DG	23,999	100MHz	16MB	2000DN	24,799	150MHz	16MB
2000DH	24,199	100MHz	16MB	2000DO	24,999	150MHz	16MB
2000DI	24,399	100MHz	16MB	2000DP	25,199	150MHz	16MB
2000DJ	24,599	100MHz	16MB	2000DQ	25,399	150MHz	16MB
2000DK	24,799	100MHz	16MB	2000DR	25,599	150MHz	16MB
2000DL	24,999	100MHz	16MB	2000DS	25,799	150MHz	16MB
2000DM	25,199	100MHz	16MB	2000DT	25,999	150MHz	16MB
2000DN	25,399	100MHz	16MB	2000DU	26,199	150MHz	16MB
2000DO	25,599	100MHz	16MB	2000DV	26,399	150MHz	16MB
2000DP	25,799	100MHz	16MB	2000DW	26,599	150MHz	16MB
2000DQ	25,999	100MHz	16MB	2000DX	26,799	150MHz	16MB
2000DR	26,199	100MHz	16MB	2000DY	26,999	150MHz	16MB
2000DS	26,399	100MHz	16MB	2000DZ	27,199	150MHz	16MB
2000DT	26,599	100MHz	16MB	2000EA	27,399	150MHz	16MB
2000DU	26,799	100MHz	16MB	2000EB	27,599	150MHz	16MB
2000DV	26,999	100MHz	16MB	2000EC	27,799	150MHz	16MB
2000DW	27,199	100MHz	16MB	2000ED	27,999	150MHz	16MB
2000DX	27,399	100MHz	16MB	2000EE	28,199	150MHz	16MB
2000DY	27,599	100MHz	16MB	2000EF	28,399	150MHz	16MB
2000DZ	27,799	100MHz	16MB	2000EG	28,599	150MHz	16MB
2000EA	27,999	100MHz	16MB	2000EH	28,799	150MHz	16MB
2000EB	28,199	100MHz	16MB	2000EI	28,999	150MHz	16MB
2000EC	28,399	100MHz	16MB	2000EJ	29,199	150MHz	16MB
2000ED	28,599	100MHz	16MB	2000EK	29,399	150MHz	16MB
2000EE	28,799	100MHz	16MB	2000EL	29,599	150MHz	16MB
2000EF	28,999	100MHz	16MB	2000EM	29,799	150MHz	16MB
2000EG	29,199	100MHz	16MB	2000EN	29,999	150MHz	16MB
2000EH	29,399	100MHz	16MB	2000EO	30,199	150MHz	16MB
2000EI	29,599	100MHz	16MB	2000EP	30,399	150MHz	16MB
2000EJ	29,799	100MHz	16MB	2000EQ	30,599	150MHz	16MB
2000EK	29,999	100MHz	16MB	2000ER	30,799	150MHz	16MB
2000EL	30,199	100MHz	16MB	2000ES	30,999	150MHz	16MB
2000EM	30,399	100MHz	16MB	2000ET	31,199	150MHz	16MB
2000EN	30,599	100MHz	16MB	2000EU	31,399	150MHz	16MB
2000EO	30,799	100MHz	16MB	2000EV	31,599	150MHz	16MB
2000EP	30,999	100MHz	16MB	2000EW	31,799	150MHz	16MB
2000EQ	31,199	100MHz	16MB	2000EX	31,999	150MHz	16MB
2000ER	31,399	100MHz	16MB	2000EY	32,199	150MHz	16MB
2000ES	31,599	100MHz	16MB	2000EZ	32,399	150MHz	16MB
2000ET	31,799	100MHz	16MB	2000FA	32,599	150MHz	16MB
2000EU	31,999	100MHz	16MB	2000FB	32,799	150MHz	16MB
2000EV	32,199	100MHz	16MB	2000FC	32,999	150MHz	16MB
2000EW	32,399	100MHz	16MB	2000FD	33,199	150MHz	16MB
2000EX	32,599	100MHz	16MB	2000FE	33,399	150MHz	16MB
2000EY	32,799	100MHz	16MB	2000FF	33,599	150MHz	16MB
2000EZ	32,999	100MHz	16MB	2000FG	33,799	150MHz	16MB
2000FA	33,199	100MHz	16MB				

NETWORK CAMERAS

Smile for the LAN Camera

Everyone, say cheese. To your PC, that is. With the release of Axis' **Axis NetEye 200** (800-444-2497, www.axis.com) and Microplex's **NetworkEye/270** (800-665-7798, www.microplex.com), digital cameras may be coming to a network near you.

These products are ideal for providing dynamic images for your intranet or Website, and they can double as a low-cost security system as well. Instead of installing a closed-circuit television system, you can use one of these digital

network cameras and direct the lens toward the area you want to monitor.

In this way, you can use your

PRIVATE EYE: The NetEye 200 has a built-in network connector.

existing Ethernet network and avoid the expensive cable installation necessary for a CCTV system. And since both the NetEye 200 and the NetworkEye/270 provide a refresh rate of one frame per second, you can capture all the action you need to catch a thief.

The \$1,299 NetEye 200 is a network camera in every sense. The palm-size device has a digital camera and a network connector built-in; on one side is the lens, and on the other there's a port for connecting to a 10-Mbps Ethernet network.

According to Axis, installation consists of giving the NetEye an IP address and connecting it to the network via the Ethernet connector. You can either point the NetEye at what you want to photograph or take photos through your

Web browser. After a picture is taken, it is compressed, transferred, and posted to a designated area of the network as a JPEG file.

Want to see the NetEye in action? Simply point your browser to Axis' Web site; there are more than a dozen links to



cameras showing live and archived footage, including shots from the Live Keiko Cam at the Oregon Coast Aquarium.

The network-camera concept holds true for the NetworkEye/270, a pocketbook-size camera (\$299 for the black-and-white version; \$349 for the color), but the implementation is different. For starters, a digital camera isn't in-

cluded with the NetworkEye: You have to purchase the Connectix QuickCam for Windows, which is the only camera the NetworkEye works with (First Looks, September 24, 1996). The QuickCam is capable of capturing up to 24

frames of color video per second. A black-and-white version is also available for \$89.

To set up the NetworkEye, you attach it to your Ethernet LAN, and then attach the camera to the NetworkEye. As for viewing images, the NetworkEye works similarly to the Net-

Eye: Go to the camera's URL and you see what the camera is seeing. All digital images are posted to the network.

Although these systems provide inexpensive ways to keep an eye on your property, neither one allows you to control the camera remotely, so the wide-angle view may not contain enough detail.—*Sarah L. Roberts*

HIGH-SPEED NETWORKING

Get into the Fast Lane: Fast Ethernet Solutions

To get on the Fast Ethernet track requires some slow thinking about the right set of products. Several new solutions allow you to migrate your network from Ethernet to Fast Ethernet, extend the segments of your existing Fast Ethernet infrastructure, and manage your Fast Ethernet network as it handles the traffic.

From D-Link Systems (800-326-1688, www.dlink.com) comes a new pair of stackable Fast Ethernet hubs. The \$2,195 **DFE-1612TX**, and the \$1,795 **DFE-1212TX**, are both 12-port stackable Fast Ethernet hubs that are extensions of the D-Link Pro FE family. These hubs stack up to five units high, which translates to a total of 60 available

Fast Ethernet ports. The DFE-1612TX also supports both in-band and out-of-band management and has an RS-232 console port for remote management. By contrast, the DFE-1212TX is an unmanaged hub.

Lantronics (800-422-7055, www.lantronix.com) has a new



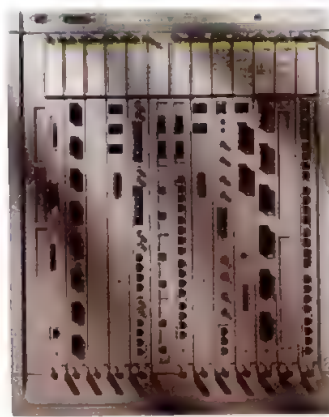
FAST FORWARD: D-Link's stackable hubs (left) and Bay Networks' System 5000 (right) ease the transition to Fast Ethernet.

line of Fast Ethernet switches, the **Lantronics Miniswitches**, designed to ease the migration from Ethernet to Fast Ethernet. The \$995 **LMS2F8-MA** is a hybrid that has eight Ethernet ports with two Fast Ethernet ports. The \$795 **LMS1F4** is a four-port Ethernet switch with one Fast Ethernet port. Neither of these switches has management capabilities built in.

Also from Lantronics is an interesting Fast Ethernet product,

the **LFX Fast Ethernet Extender**, which lets you extend the distance of a Fast Ethernet segment beyond the 100-meter standard or add a Fast Ethernet link to an Ethernet network. The **LFX2** and **LFX2-MA** sell for \$450 and \$595, respectively. The higher-priced model has two RJ-45 connectors, an AUI connector, and an MII connector for Fast Ethernet.

Weighing in from Bay Networks (800-776-6895, www.baynetworks.com) are the **System 3000** and **System 5000** Fast Ethernet hub platforms, both of which deliver 100Base-T connectivity. The System 3000 has 24 ports and is a chassis-based solution; the System 5000 allows network managers to add shared Fast Ethernet to network centers. Both are designed to provide a smooth migration from 10 Mbps to 100 Mbps. These systems come with a wide variety of options and costs. Prices range from \$1,995 to \$7,485.—*SLR*



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LCD DIGITAL CAMERA QV-100

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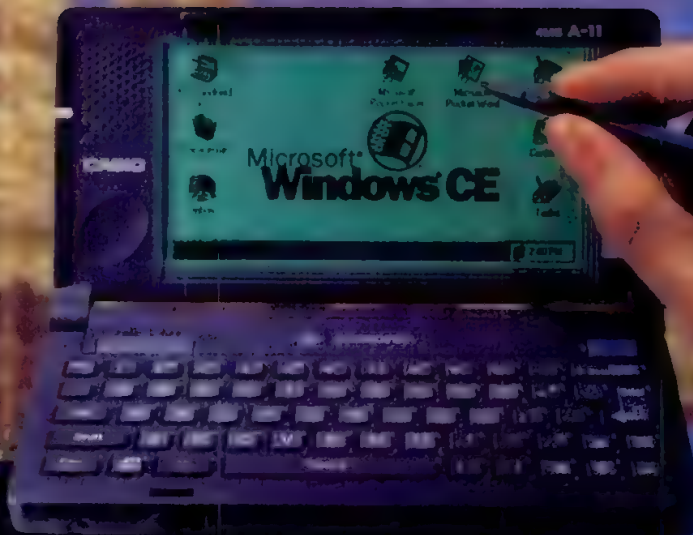
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First Looks



Windows 95 Phones Home

These five programs bring new levels of convenience and power to desktop communications.—By Edward Mendelson

Imagine this for a moment: Rip van Winkle falls asleep in 1986 while waiting for his 2,400-bps modem to complete a file download to his character-mode communications program and wakes up in the present to find a Windows 95 computer with the latest communications software churning through data at a rate ten times as fast. Today's communications programs still perform the basics that were familiar a decade ago—file transfers and terminal-style communications—across telephone lines. But Rip would discover that his up-to-date program also serves as both an answering machine and a complete fax system, and that it can launch his Web browser with the click of a mouse.

The latest communications packages fall into two basic categories: single-function terminal programs, such as Hilgraeve's \$129 HyperAccess for Windows 95 and NT and BMT Micro's \$69 ZOC, and all-in-one packages

that combine data, fax, voice, and Internet features, such as 01 Communiqué Laboratory's \$179 Communicate!, Global Village Communication's \$100 Focal Point, and Quarterdeck Corp.'s \$100 Procomm Plus for Windows. Single-function fax packages—Symantec's WinFAX Pro, for instance—are fading because Windows 95 includes basic—albeit cumbersome—fax features.

The terminal programs we looked at operate either across telephone lines or as Internet telnet programs. But our trio of all-in-one communications centers also add voice messaging, speakerphone, fax, e-mail, and Internet features; what you get may depend on what's built into your modem, though. If you have a voice modem, Communicate! and Focal Point can turn your computer into an answering machine; both are designed for the small office with a single phone line. Procomm Plus doesn't support voice functions, but

it includes just about every other telephony feature.

On our file-transfer tests, we found little performance difference among these five programs, with one exception. When using HyperAccess's proprietary HyperProtocol, HyperAccess stood out with the fastest times on both our file-transfer tests, but you need HyperProtocol running at both ends of the data conversation.

One innovative feature that all these programs lack is the ability to send fax and voice messages to your computer via e-mail. JFAX Personal Telecom (888-438-5329; www.jfax.net) is a service that sets up a fax-and-voice mailbox for you in any of half a dozen cities. Arriving faxes and messages are digitized and sent to your e-mail address, where you can view or hear them using free software supplied by JFAX. The service costs \$12.50 per month for 100 messages after an initial \$15 setup fee.

INSIDE

TOOL TIME: Symantec's Norton Utilities 2.0 has just the fix for Windows 95 users. See page 60 for a full review.



MOVE OVER MOUSE: CIC's Manta Handwriter is a notepad for your PC. For details, see page 76.



WHAT'S ON PC? With NetTV's InstantTV, you don't have to leave your desk to watch your favorite television programs. See page 70.

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First Looks Online

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WWW.PCMAG.COM/DISCUSS.HTM



First Looks

Communicate! 8.0

List price: \$179

Requires: 8MB RAM, 15MB hard disk space, Microsoft Windows 3.1 or later

01 Communiqué Laboratory
Mississauga, Ontario, Canada
800-668-2185, 905-795-2888

www.01com.com

Circle 416 on reader service card



Whether you're interested in connecting to a BBS, sending a fax, or just nosing around the Web, one of these programs is sure to fit your needs.

01 Communiqué Laboratory Communicate!

Hidden behind Communicate!'s compact but inconsistent interface is an enormous range of telephony and communications features geared toward small businesses and home offices that have only one phone line. This \$179 package from 01 Communiqué Laboratory includes voice mailboxes, outgoing recorded voice messages, e-mail, fax sending and receiving, fax back, remote message retrieval by fax and voice, and a data terminal.

Communicate!'s main screen is designed to look like a telephone. There are speed-dial buttons and a receiver on the left, a caller ID display and touch pad in the middle, and two button panels on the right—one for controlling telephone features, the other for accessing fax, e-mail, and other features.

Above these button panels is a picture of a cassette tape with controls for recording calls and playing back memos.

A single message log lists all incoming data files, e-mail, faxes, and voice messages, but you have to drill down to a second dialog box and click on a Launch button to view a file attachment. Similarly, you can't listen to a voice message simply

by clicking on its entry in the log; you have to click on a button that opens up a dialog box where you'll find the Play button. If you use a U.S. Robotics voice modem, the program records the messages in U.S. Robotics' .GSM format, which can be played back through the modem speaker but not through your sound card.

Setup options throughout the program are extensive but clumsily implemented. For example, the voice mailbox system can be used with the supplied recorded greetings, and a simple dialog box lets you choose whether you want callers to have the option of leaving a message, a fax, or a request for a fax back. But if you want to use a greeting of your own, you need a good memory

for filenames, because the text of the supplied sound files is displayed not in the menu where you actually select the sound file but in one of the setup menu's tabbed dialog boxes.

Communicate!'s interface ignores some basic Windows 95 conventions. The main window has no title bar, no top-line menu, and no Close button. Instead, you must click on the Power button to close the program down, and to view the speed-dial buttons you have to remember to click on the receiver first. All features have keyboard shortcuts, but they aren't documented.

The terminal window has a Quick Phone Book for listing frequently used BBSs and services, but you can't transfer an address between the Quick Phone Book and the package's central address book. And you can open the terminal's host mode only from the main setup menu not from the terminal itself. Though you can set the modem's connect speed for each choice, the default terminal connect speed is 9,600 bps—an anachronism in an age of 33.6-Kbps hardware.

A blue light-bulb icon on the terminal screen records a log-on script, but this feature isn't listed on any of the menus. The scripting language is simple but adequate for basic BBS access; the only emulation available is ANSI.

We tested a 16-bit version, which frequently crashed on one of our test-beds—an IBM ThinkPad 760ED with a PC Card modem. It also crashed on our other test-bed when we tried to view a .PCX file attachment; a 32-

bit version that we hope is more robust should be ready by the time you read this. Communicate! was an average performer on both the 100K and 1MB file-transfer tests.

Though Communicate! has its weak points, if 01 Communiqué can improve its reliability and interface, this program will be a major contender in the PC telephony market.

Global Village Communication

Focal Point



Global Village Communication's \$129 Focal Point 5.5 combines voice mailboxes, fax and fax-back, e-mail, and traditional terminal functions in an elegant,

lucid, and superbly integrated interface that makes even the most complex options easy to set up and use.

The program offers almost every imaginable telephony function, and wizard-style dialog boxes let you set up a fax-back system, create password-protected voice mailboxes, apply OCR to incoming faxes, send messages to alphanumeric pagers, automatically check your e-mail, and retrieve your messages remotely. With a few mouse clicks, you can send a single message via e-mail, fax, or the alphanumeric pager system.

Focal Point's main window displays different modules depending on your modem's capabilities. With a voice modem, the window has four large modules, for voice mail, faxes and e-mail, manual dialing and receive-

Communications Programs: Side by Side

	Communicate!	FocalPoint	HyperAccess for Windows 95 and NT	Procomm Plus for Windows 95	ZOC
Record log-on script	✓	✓	✓	✓	✓
E-mail	✓	✓	✗	✗	✗
Fax/Fax-on-demand	✓✓	✓✓	✓✗	✓✗	✗✗
Send recorded message	✓	✗	✓	✗	✗
Voice mailboxes/Remote control	✓✗	✗✗	✗✗	✗✓	✗✗

Editors' Choice

- All-in-One Communications: Focal Point 5.5
- Terminal Communications: HyperAccess for Windows 95 and NT



Terminal-based communications, whether through Internet telnet connections or plain old telephone lines,

has never been done better than by Hilgraeve's \$129 HyperAccess for Windows 95 and NT. Elegant, clear menus and tight integration with Windows and the Internet make it our Editors' Choice among the terminal programs we looked at.

HyperAccess includes ten terminal emulation modes, a built-in graphics viewer and editor, and instant access to a Web site through a click on a URL. With its proprietary transfer protocol,

ing, and the program's address book. Smaller buttons are used for creating new e-mail or faxes, dialing a number directly, jumping to the message lists, and other options.

The voice mail module lists the number of current and old messages, along with the date, time, and duration of the most recent message. VCR-style controls let you play back messages, and buttons beneath the controls let you

also route incoming calls directly to a voice mailbox. Tabbed pages in the address book offer speed-dial buttons and listings by person and by company.

In terminal mode, you can choose to connect to a BBS, start up in host mode, or issue commands to the modem. Log-ons can be recorded as scripts, and although the language is less powerful than the ones in Procomm and HyperAccess, it is much eas-

ier to learn. Only the most common terminal emulations are provided, but they're all that most users need.

The message and fax viewer doubles as a file manager with built-in viewers for major file formats. Mail attachments are displayed in the same pane as the contents of disk files. You can create folders for storing e-mail, but the program has no automated filing rules. If you have caller ID, voice-mail messages are identified by name and you can set the program to respond automatically to specified numbers by refusing the call or accepting a fax. You can use distinctive rings to route calls to different mailboxes, but you can't use the caller ID and distinctive-ring features simultaneously.

Focal Point is a mix of 16- and 32-bit code that can't recognize long filenames. But Focal Point can dial out to the Internet using Windows 95 Dial-Up Networking. At first, this version could not transfer files when caller ID was not available, but Global Village has posted an update on its Web site that fixes this problem but inexplicably made us lose the ability to initialize our U.S. Robotics Sportster.

Like Communicate!, Focal Point yielded average performance results on file transfers: 18 seconds for a 100K file and 3

minutes 2 seconds for a 1MB file. With its superb interface and vast range of features, Focal Point can make a business or home office with a single telephone line seem as if it has a corporate PBX humming away in the background.

Hilgraeve Inc.

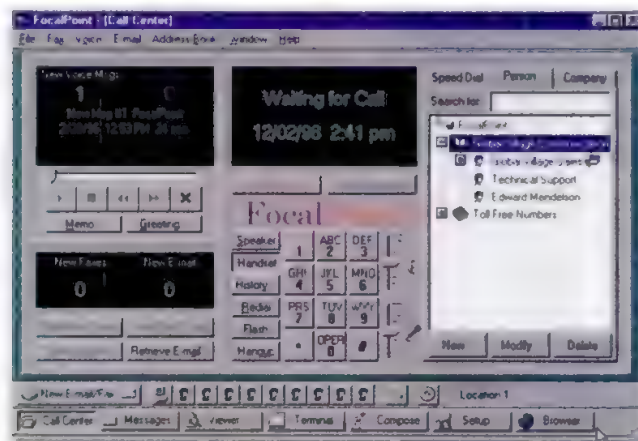
HyperAccess for Windows 95 and NT



Hilgraeve's long-awaited HyperAccess for Windows 95 and NT doesn't try to be anything more than a terminal program,

but it's the best terminal program you can buy. The \$129 package also offers tighter integration with Windows and the Internet than any of the all-in-one packages does. HyperAccess is the commercial big brother of the HyperTerminal application that comes with Windows 95. HyperAccess has a derivative interface, but it's chock full of communications power.

Based on 32-bit code, HyperAccess retains the speed and simplicity of its earlier versions, and it works closely with any Web browser. Connection data can be stored either as separate files with detailed information for each site or as ordinary text-file lists. Remote sites stored in



send a memo to another voice mailbox or record a new greeting. The fax and e-mail module lists new faxes and messages, and buttons let you view or retrieve e-mail and see either all faxes or only new ones.

The dialing module has a numeric keypad, volume controls for the microphone and speaker, a most recently dialed list, and buttons for mute and hold. You can

Focal Point 5.5

Street price: \$100

Requires: 8MB RAM, 17MB hard disk space, Microsoft Windows 3.1 or later

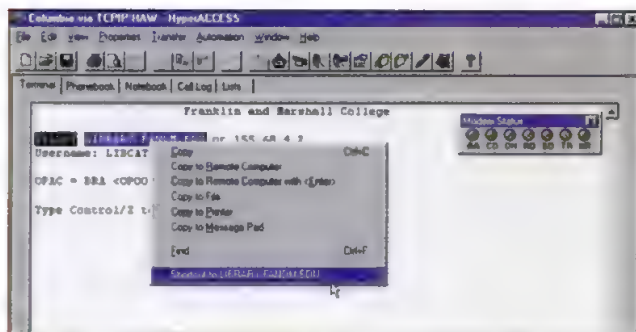
Global Village Communication
Sunnyvale, CA

800-329-9675, 408-523-1000

www.globalvillage.com

Circle 417 on reader service card

First Looks



HyperAccess for Windows 95 and NT

List price: \$129

Requires: 8MB RAM, 6MB hard disk space, Microsoft Windows 95 or Windows NT 4.0

Hilgraeve Inc., Monroe, MI
800-826-2760, 313-243-0576

www.hilgraeve.com

Circle 418 on reader service card

text-file lists can be converted into connection files via a toolbar button or drag and drop.

The terminal window is clean, refined, and uncluttered, with a simple menu structure and toolbar that emulate the best elements of Microsoft Office. All major functions are accessible from the file menu. Instead of the traditional Chat window where you enter text live, there's a miniature editor you can use to import, edit, and spell-check text with standard Windows editing keys.

Image files are displayed in a built-in viewer as they arrive on your system. Host mode is implemented as a separate full-featured program, not as a script as it is in other packages. When you highlight a Web address, a right-click menu includes an option to open the site in your browser.

You can choose from among ten terminal emulation modes—not as many as Procomm has but almost certainly more than you'll ever need. Tabbed property pages give you easy access to all options. Automated scripts can be written or recorded either in VisualBasic or JavaScript; OLE scripting makes it easy for pro-

grammers to integrate HyperAccess with other Windows and Internet applications. Non-programmers who need to modify a recorded script can puzzle out the basics in the internal script editor, but the learning curve is steeper than in Procomm's Aspect language.

A streamlined terminal program, HyperAccess was the only product that stood out in terms of performance on file transfers. But it excelled only when using its proprietary HyperProtocol in place of Zmodem. With HyperProtocol enabled at both ends, it required only 14 seconds to transfer a 100K file and 2 minutes 45 seconds to transfer a 1MB file—the best results in both categories.

HyperAccess ships without a printed manual, but the CD-ROM contains an Adobe Acrobat rendition; the printed version costs \$9.95. This is the one minor annoyance in this otherwise marvelous package.

Quarterdeck Corp.

Procomm Plus

Procomm Plus for Windows 95—newly acquired by Quarterdeck—combines strong terminal-emulation features with Internet mail, browsing, and other functions. This \$139 program, aimed at those who need an integrated 32-bit communications powerhouse, also has a gracefully designed fax module and a remote-control add-on. But Procomm Plus looks and feels more like a set of loosely related modules than a single entity.

You access most of Procomm from a central-connection directory. Tabbed pages let you add addresses for data, fax, and voice calls, and Internet addresses for e-mail, newsgroups, and FTP and telnet sites. When you click on an address, Procomm launches the appropriate

module and initiates a connection. You can sort sites into separate directory files or use one directory for all sites; the program ships with directories for major FTP and Web sites, and BBS systems.

Each module has a menu that leads to all other modules, and the terminal and Internet modules have convenient drop-down lists of all the entries in the current address directory. Wizard-style dialog boxes guide you through the basics—sending a fax, for example—but more powerful features and options are buried in hard-to-find sub-dialogs boxes.

The terminal module communicates with your modem through Windows 95's telephony interface; the modules that access the Internet use Windows 95's Dial-Up Networking. Procomm's powerful Aspect script language can be used effectively even by non-technical users, but you can only record scripts in the telnet and terminal windows. Toolbars are easily customized, and advanced users can use the script language to modify the drop-down menus.

Terminal features are especially rich: There are 36 customizable emulation modes, all with matching keyboard layouts. Downloaded graphics are displayed progressively as they arrive on your system. Procomm's ugly screen fonts can be replaced with any fixed-pitch font on your system, although you must use the supplied fonts if you want to see all the characters used on some arcane terminal types.

Procomm's fax module is a real gem. Unlike Procomm's overloaded terminal screen, it is clear, well-organized, and more useful than Microsoft Fax and not as bulky as Symantec's WinFAX Pro. To create a fax, you can either use the Fax Manager or print to the Procomm fax driver from any Windows application. A simple

PERFORMANCE TESTS

Communications Software



All five programs transferred the test files in roughly the same amount of time using the Zmodem protocol. HyperAccess's proprietary HyperProtocol was notably faster than Zmodem, but both sending and receiving systems need to run HyperAccess.

We timed how long it took to send a 100K binary file and a 1MB file consisting mostly of text between copies of each program. The sending modem was a U.S. Robotics Sportster attached to a Pentium Pro/200 system; the receiving modem was a Motorola Montana fax modem PC Card in an IBM ThinkPad 760ED.

FILE TRANSFER

Lower scores represent better performance
Bold type denotes first place

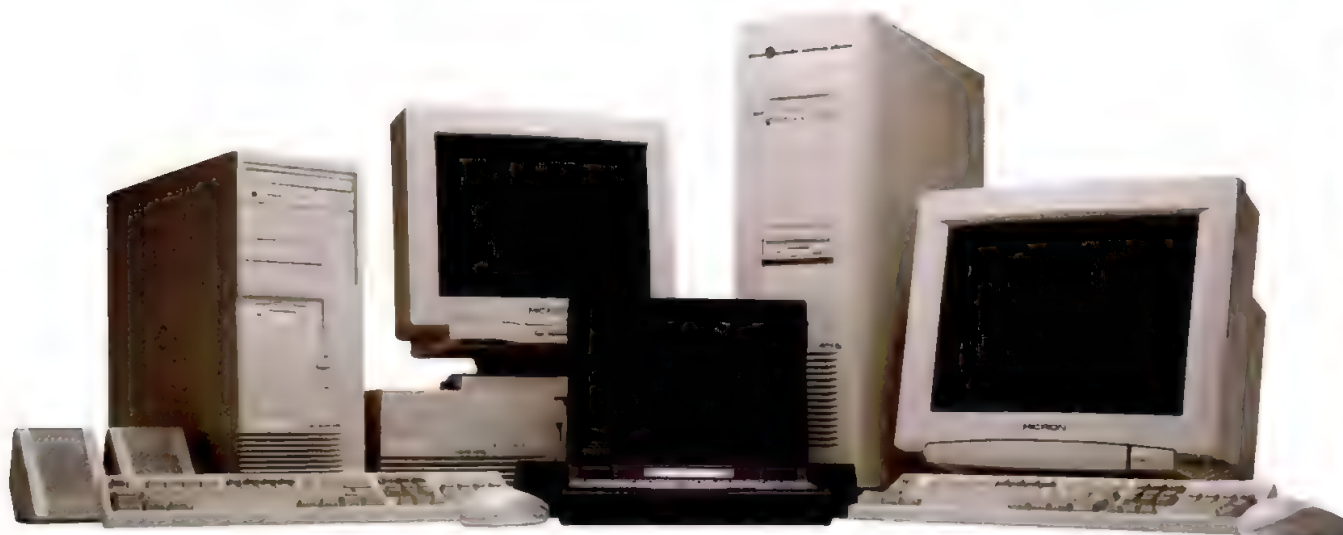
	100K binary file Seconds	1MB text file Minutes seconds
Communicate!	18	3:02
FocalPoint	18	3:02
HyperAccess (with Zmodem)	18	3:01
HyperAccess (with HyperProtocol)	14	2:45
Procomm Plus for Windows 95	19	3:02
ZOC	18	3:03

THE REVIEWS ARE IN...

MICRON
ELECTRONICS, INC.

WE THINK YOU'LL AGREE

Micron is the
superior choice.



Introducing the **MILLENNIA™ MXE**

Micron now offers an exciting new desktop
solution that incorporates the advanced MMX™
performance-enhancing technology.
(see configs for details)





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The Millennium MXE is the perfect system for uncompromising home or office PC users.

Significantly faster than classic Pentium® processor-based systems, the Millennium MXE improves your productivity. Integrating Micron's proven Millennium design with the advanced MMX technology from Intel, the Millennium MXE dramatically accelerates the performance and enhances the quality of existing and emerging multimedia and communication software. Call Micron Electronics™ today to order your new Millennium MXE and get the advanced technology that takes computing to a new level of performance.

ADVANCED DESKTOP SOLUTIONS

Millennia™ Mxe P166

With Intel 166MHz Pentium processor with MMX technology & 32MB internal cache add \$200

INTEL 166MHz PENTIUM® PROCESSOR WITH MMX™

- 512KB pipeline burst cache, flash BIOS
- 12X EIDE CD-ROM drive, 3.5" floppy drive
- 100MB Imomage® Zip® Drive
- Sound Blaster® 32 Waveable 3D stereo sound card with speakers
- PCI 64-bit 3D video, MPEG, 4MB EDO RAM
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- Microsoft® Mouse, 104-key keyboard
- Microsoft Windows® 95 & MS® Plus! CD
- MMX Enabled Software: Adobe® Photo Deluxe, Pod, Eraser, Blackbuster® Entertainment & Billboard Music Guide
- 5-year/3-year Micron Power™ warranty

- 16MB EDO RAM
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- 15" Micron 15FGx, 20dp (13.7" display)
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\$1,999
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- 32MB EDO RAM
- 2.5GB EIDE hard drive
- 15" Micron 15FGx, 20dp (13.7" display)
- Microsoft Office CD

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- 64MB EDO RAM
- 3.1GB EIDE hard drive
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- 12X SCSI CD-ROM drive, 3.5" floppy drive
- 100MB Imomage Zip Drive
- Sound Blaster 32 Waveable 3D stereo sound card with speakers
- PCI 64-bit 3D video, MPEG, 4MB EDO RAM
- Tool-free minitower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows 95 & MS Plus! CD
- MMX Enabled Software: Adobe Photo Deluxe, Pod, Eraser, Blackbuster Entertainment & Billboard Music Guide
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- 2GB Ultra SCSI hard drive
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- Microsoft Works 95 CD

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- 4GB Ultra SCSI hard drive
- 15" Micron 15FGx, 20dp (13.7" display)
- Microsoft Office CD

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- 64MB EDO RAM
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- Microsoft Office CD

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ECONOMICAL DESKTOP SOLUTIONS

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INTEL 166MHz PENTIUM® PROCESSOR

- 512KB pipeline burst cache, flash BIOS
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- PCI 64-bit 3D video, MPEG, 2MB EDO RAM
- Tool-free minitower or desktop
- Microsoft® Mouse, 104-key keyboard
- Microsoft Windows® 95 & MS® Plus! CD
- 5-year/3-year Micron Power™ warranty

- 16MB EDO RAM
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- Microsoft Works 95 CD
- 15" Micron 15FGx, 20dp (13.7" display)

\$1,699
Bus. lease \$38/mo.

- 32MB EDO RAM
- 2.5GB EIDE hard drive
- Microsoft Works 95 CD
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\$2,199
Bus. lease \$75/mo.

Micron Power
Warranty & Support

- 5-year limited warranty on microprocessor and main memory
- 3-year limited parts-only system warranty
- 1-, 2- or 3-year optional on-site service agreement for Micron desktop systems
- 30 days of free Micron-supplied software support for Micron desktop systems
- 30-day money-back policy
- 24-hour technical support

*The foregoing is subject to and qualified by Micron's standard limited warranties and terms and conditions of sale. Terms and conditions of sale may vary for specific configurations. Copies of the limited warranties may be obtained on our Web site or by calling Micron.

A New Millennium

Micron's Millennium Pro
Flies High With 200MHz
Of Pentium Pro Power

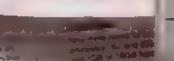
37 Products Reviewed



Corel 3D-140



HP LaserJet LaserJet 6P



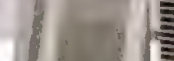
HP LaserJet LaserJet 6P



HP LaserJet LaserJet 6P



HP LaserJet LaserJet 6P



HP LaserJet LaserJet 6P



HP LaserJet LaserJet 6P



HP LaserJet LaserJet 6P



HP LaserJet LaserJet 6P



HP LaserJet LaserJet 6P



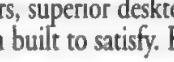
HP LaserJet LaserJet 6P



HP LaserJet LaserJet 6P



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Outstanding Performance—Don't Take Our Word for It.

Talk is cheap when you're speaking for yourself. But when it's from the mouth of an industry expert, it carries weight. Here are a few of many examples of what they're saying about Micron PCs:

- | | | |
|------------------------------|--|--------------------------|
| Micron Home MPC™ | "... the fastest we've ever tested... as well as a marvelous family package... it wins our Top Rated award..." | —Family PC, May 1996 |
| Micron Millennium™ | "In short, Micron covers all the bases with this Best Buy" | —PC World, March 1996 |
| Micron Millennium TransPort™ | "... nearly a dead ringer for IBM's ThinkPad... but performs better and saves you about \$2,500." | —PC Magazine, April 1996 |

The Right System for You

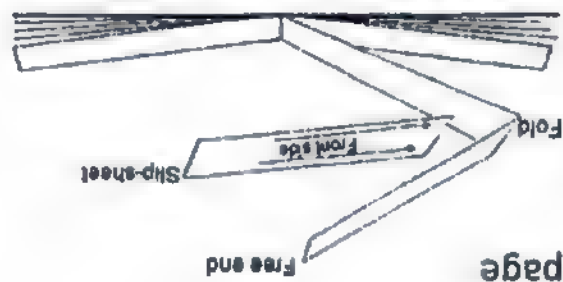
Micron makes a suite of outstanding solutions designed for the way you work or play. From exciting home systems to custom servers, superior desktop PCs to exceptional portable multimedia solutions, Micron always comes through with a system built to satisfy. For details and prices, turn the page.

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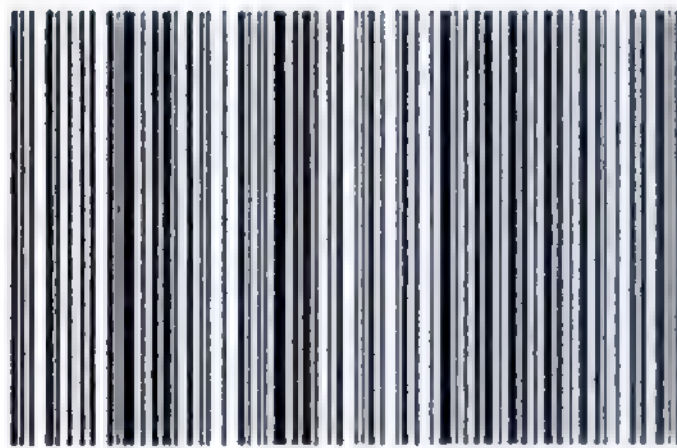
<http://www.mei.micron.com>





1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Inverted Foldout slip-sheet

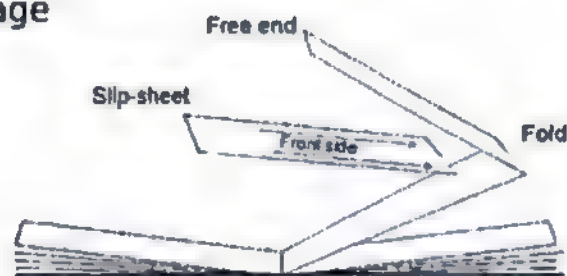


GbsSlipSheet-001

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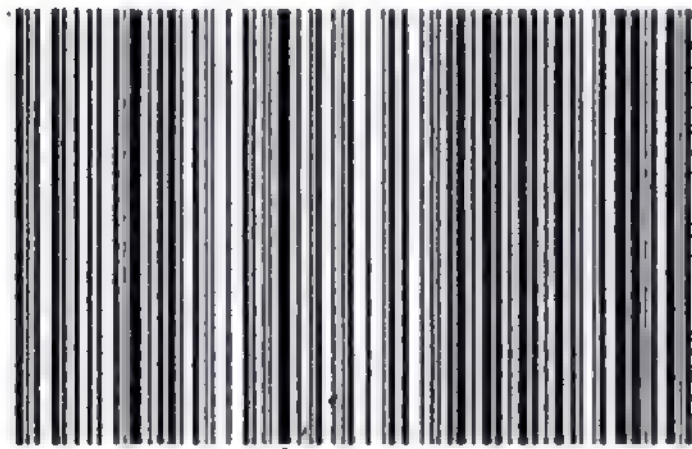
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

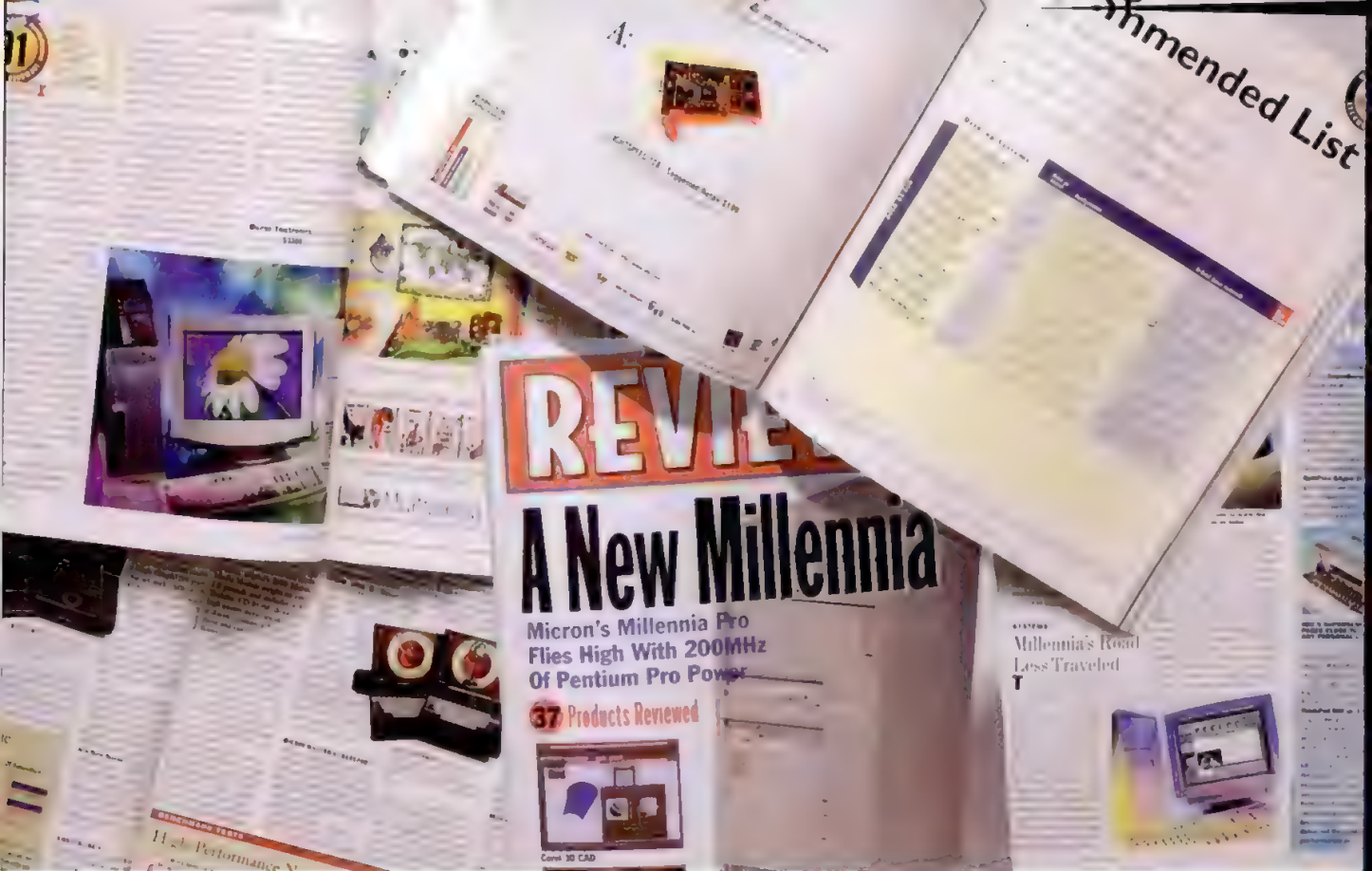
Inverted Back



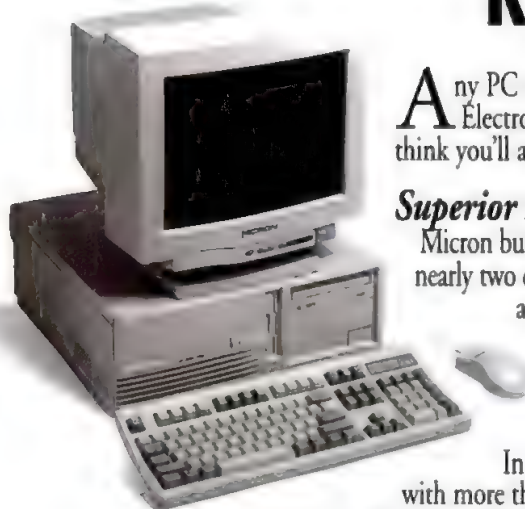
GbsSlipBack-001B

Back

1. Follow instructions on the other side



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Any PC maker can claim to offer a solution that covers your needs. But at Micron Electronics™, we prefer to let our history and our products speak for themselves. We think you'll agree it's an impressive story.

Superior Manufacturing—A Micron Tradition

Micron builds PCs with a legacy of excellence. Our manufacturing processes grew out of nearly two decades in the semiconductor business, where precision is measured in millionths of an inch, and quality in parts per million. We've built strategic relationships with companies like Intel, Microsoft and Novell. From this solid background, we're forging unbeatable systems you can count on today and tomorrow.

Award-Winning Products

In the past two years, leading industry publications have applauded Micron PCs with more than 170 awards for product performance, customer service and support. This includes *PC Magazine's* Best Products of 1995 and Editors' Choice awards in several categories. Add more than 40 *PC World* Best Buy awards and you've got an impressive technology hall of fame.

Recognized Service and Reliability

After your purchase, the story continues. Just ask *PC Magazine* readers. They bestowed on us the coveted Readers' Choice for Customer Service and Reliability in 1994 and 1995. And *PC World* readers recently rated Micron the best overall PC company for reliability and service in 1996.

Micron PowerSM Warranty—An Industry First

We support our reliability promise with the industry-leading Micron Power warranty. It backs the microprocessor and main memory for five years, an industry first. Add a three-year, parts-only system warranty and a 30-day money-back guarantee, and you can rest assured that you're in good hands.

POWER DESKTOP SOLUTIONS

Millennia™ Pro2 180

INTEL 180MHz PENTIUM® PRO PROCESSOR

- Supports dual Intel 180MHz Pentium Pro processors
- 256KB internal cache, flash BIOS
- 12X EIDE CD-ROM drive, 3.5" floppy drive
- 16-bit stereo sound & speakers
- PCI 64-bit 3D video, MPEG, 4MB EDO RAM
- Tool-free minitower or desktop
- Microsoft® Mouse, 104-key keyboard
- Microsoft Windows® 95 & MS® Plus! CD
- 5-year/3-year Micron Power® warranty

With 2nd Intel 180MHz Pentium Pro processor
With Microsoft Windows NT® Workstation 4.0 CD
*Second processor requires Microsoft Windows NT Workstation 4.0

- 16MB EDO RAM
- 2.5GB EIDE hard drive
- 15" Micron 15FGx, .28dp (13.7" display)
- Microsoft Works 95 CD

\$2,199
Bus. lease \$75/mo.

- 32MB EDO RAM
- 3.1GB EIDE hard drive
- 17" Micron 17FGx, .26dp (15.8" display)
- Microsoft Office CD

\$2,699
Bus. lease \$92/mo.

Millennia™ Pro2 400 Plus

DUAL INTEL 200MHz PENTIUM® PRO PROCESSORS

- 256KB internal cache, flash BIOS
- PCI 32-bit Ultra SCSI Fast-20 controller
- 12X SCSI CD-ROM drive, 3.5" floppy drive
- 16-bit stereo sound & speakers
- PCI 64-bit 3D video, MPEG, 4MB EDO RAM
- Tool-free minitower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows NT Workstation 4.0 CD
- Microsoft Office CD
- 5-year/3-year Micron Power warranty

- 32MB EDO RAM
- 2GB Ultra SCSI hard drive
- 15" Micron 15FGx, .28dp (13.7" display)

\$3,899
Bus. lease \$133/mo.

- 64MB EDO RAM
- 4GB Ultra SCSI hard drive
- 17" Micron 17FGx, .26dp (15.8" display)

\$4,799
Bus. lease \$163/mo.

- 128MB EDO RAM
- 9GB Fast SCSI-2 hard drive
- 21" Micron 21FGx, .26dp (20.0" display)

\$6,999
Bus. lease \$220/mo.

EXCITING HOME SOLUTIONS

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INTEL 166MHz PENTIUM® PROCESSOR

- 512KB pipeline burst cache, flash BIOS
- 16MB EDO RAM
- 1.6GB EIDE hard drive
- 12X EIDE CD-ROM drive, 3.5" floppy drive
- 16-bit stereo sound & speakers
- 33.6 fax/modem, speakerphone, voice mail
- Microsoft® Phone telephony software
- Internet ready: Free 1 month Spry® Internet access, Microsoft Internet Explorer® 3.0
- America Online® & CompuServe® trial memberships
- PCI 64-bit 3D video, MPEG, 2MB EDO RAM

- 15" Micron 15FGx, .28dp (13.7" display)
- Tool-free minitower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows® 95 & MS® Plus! CD
- Quicken® Financial Pak includes: Quicken Deluxe 6.0, Quicken Financial Planner®, Quicken Parents' Guide to Money™ and Quicken Family Lawyer™ (includes FREE TurboTax® 1996 coupon!)
- Family Pak includes: ABC by Dr. Seuss, Thinkin' Things® Collection 1, Earthworm Jim™ and Mechwarrior® 2
- Microsoft Home Pak includes: Works 4.0, Publisher Deluxe, Encarta® Encyclopedia, Monster Truck Madness™ and CD sampler
- 5-year/3-year Micron Power® warranty

\$1,999

Home MPC™ P200

INTEL 200MHz PENTIUM® PROCESSOR

- 512KB pipeline burst cache, flash BIOS
- 32MB EDO RAM
- 2.5GB EIDE hard drive
- 12X EIDE CD-ROM drive, 3.5" floppy drive
- 16-bit 3D Waveable stereo sound card
- Advent® AV270 2x25 watt stereo speakers
- 33.6 fax/modem, speakerphone, voice mail
- Microsoft Phone telephony software
- Internet ready: Free 1 month Spry Internet access, Microsoft Internet Explorer 3.0
- America Online & CompuServe trial memberships
- PCI 64-bit 3D video, MPEG, 2MB EDO RAM

- 17" Micron 17FGx, .26dp (15.8" display)
- Tool-free minitower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows 95 & MS Plus! CD
- Microsoft Office CD
- Quicken Financial Pak includes: Quicken Deluxe 6.0, Quicken Financial Planner, Quicken Parents' Guide to Money and Quicken Family Lawyer (includes FREE TurboTax 1996 coupon!)
- Family Pak includes: ABC by Dr. Seuss, Thinkin' Things Collection 1, Earthworm Jim and Mechwarrior 2
- Microsoft Home Pak includes: Works 4.0, Publisher Deluxe, Encarta Encyclopedia, Monster Truck Madness and CD sampler
- 5-year/3-year Micron Power warranty

\$2,899

CUSTOM SERVER SOLUTIONS

Vetix™ EL 1000

INTEL 200MHz PENTIUM® PRO PROCESSOR

- Dual Pentium Pro ZIF sockets
- 256KB L2 cache, flash BIOS
- Memory upgradable to 512MB
- Slots: 1 ISA, 3 PCI, 1 shared PCI/ISA
- Adaptec® PCI 32-bit Ultra SCSI Fast-20 controller
- 12X SCSI-2 CD-ROM drive, 3.5" floppy drive
- 64-bit 1MB ISA video
- 3Com® 3C905-TX Fast EtherLink® PCI 10/100-base-TX
- Full-size tower with 10 drive bays
- 15" Micron 15FGx, .28dp (13.7" display)

- Microsoft® Mouse, 104-key keyboard
- Microsoft Windows NT® Server 4.0 (10 user license)
- NOS support (3 incident resolutions)
- 5-year/3-year Micron Power® warranty

\$4,299
Bus. lease \$146/mo.

- 32MB ECC EDO RAM
- 2GB Ultra SCSI hard drive

\$4,799
Bus. lease \$163/mo.

- 64MB ECC EDO RAM
- 4GB Ultra SCSI hard drive

Vetix™ EL 2000

DUAL INTEL 200MHz PENTIUM® PRO PROCESSOR

- 256KB L2 cache, flash BIOS
- Memory upgradable to 512MB
- Slots: 1 ISA, 3 PCI, 1 shared PCI/ISA
- Adaptec PCI 32-bit Ultra SCSI Fast-20 controller
- 12X SCSI-2 CD-ROM drive, 3.5" floppy drive
- 64-bit 1MB ISA video
- 3Com® 3C905-TX Fast EtherLink® PCI 10/100-base-TX
- Full-size tower with 10 drive bays
- 15" Micron 15FGx, .28dp (13.7" display)
- Microsoft® Mouse, 104-key keyboard

- Microsoft Windows NT Server 4.0 (10 user license)
- NOS support (3 incident resolutions)
- 5-year/3-year Micron Power warranty

\$5,599
Bus. lease \$176/mo.

- 64MB ECC EDO RAM
- 4GB Ultra SCSI hard drive

\$6,699
Bus. lease \$210/mo.

- 128MB ECC EDO RAM
- Two 4GB Ultra SCSI hard drives

EXCEPTIONAL PORTABLE SOLUTIONS

Millennia TransPort™

MOBILE INTEL PENTIUM® PROCESSOR

- Intel 430MX PCI chipset
- 256KB L2 pipeline burst cache
- BX modular CD-ROM drive
- PCI graphics accelerator, 1MB EDO RAM
- Pick-a-Point™ dual pointing devices integrate both pointing stick and touchpad
- Removable EIDE hard drive
- 3.5" modular floppy drive
- Intelligent modular lithium-ion battery
- 16-bit stereo sound
- Built-in stereo speakers and microphone
- Motorola® Montana 33.6 fax/modem

- 2 type II or one type III PCMCIA slots
- S-video and NTSC-video outputs
- Headphone, microphone and line-in jacks
- 2 infrared ports, one front, one back
- Parallel, serial, VGA and 2 PS/2® ports
- Dimensions: 11.7" x 9.4" x 2.0", weight: 6.9 lbs.†
- Nylon carrying case
- Microsoft® Windows® 95 and MS® Plus! CDs
- Microsoft Office CD
- Kensington™ security lock ready**
- 5-year/3-year Micron Power® warranty

† 6.9 lbs. includes 3.5" floppy and one battery.
** Lock secures both Millennium TransPort and MicroDock.

- 133MHz mobile Intel Pentium processor
- 32MB EDO RAM (48MB max.)
- 12.1" active matrix color display, 800x600
- 1.3GB removable hard drive

\$3,999
Bus. lease \$136/mo.

- 133MHz mobile Intel Pentium processor
- 48MB EDO RAM (48MB max.)
- 12.1" active matrix color display, 800x600
- 2.1GB removable hard drive

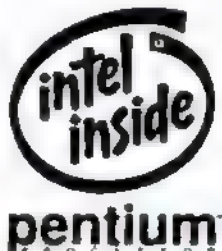
\$4,399
Bus. lease \$150/mo.

OPTIONS

- With 16MB DIMM upgrade add \$349
- With 2nd lithium-ion battery add \$199
- With 2.1GB primary hard drive upgrade add \$100
- With MicronDock™ multimedia port replicator add \$299
- With MicronExec™ desktop package add \$799
- With car adapter add \$89



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Make a Great PC Even Better!

Custom configure your new Micron Electronics system with these popular options.

Multimedia Options

- 16-bit 3D Waveable stereo sound\$59*
- 16-bit 3D Waveable stereo soundcard w/2MB RAM\$99*
- Advent® AV270 Powered Partners® stereo speakers\$99
- Advent AV370 Powered Partners stereo speakers w/subwoofer\$199
- Microsoft® SideWinder® 3D Pro joystick\$59

Storage/Media Options

- Adapter® 2940U Ultra SCSI Fast-20 controller\$100
(upgrade from system with standard Ultra SCSI Fast-20 controller)
- Plextor® 1224X 12X 1.8MB/sec SCSI internal CD-ROM drive\$200**
(upgrade from systems with standard 12X EIDE CD-ROM drive)
- Iomega® Jaz® SCSI drive with 1GB removable cartridge\$399**
- Iomega Zip® IDE drive with 100MB removable cartridge\$99
- Iomega 6-pak of 100MB Zip cartridges\$99
- Iomega Datto® 800 (400/800MB) Truven® tape backup w/tape\$149
- Iomega Datto 3200 (1.6/3.2GB) Truven tape backup w/tape\$199
- Sony® 4/GB SCSI DDS-2 DAT tape backup w/tape\$99**

Communications Options

- 33.6kb V.34 internal data/fax modem\$39***
- 33.6kb V.34 internal telephony data/fax modem w/full duplex speakerphone and voice mail\$159***†

Networking Options

- 3Com® 3C509 ethernet ISA NIC (DNC, AUI & RJ-45)\$99
- 3Com 3C595 Fast EtherLink® PCI 10/100 NIC (RJ-45 only)\$159
- 3M® ISA TokenCard network card\$199

Quicken® Financial Pak

- Quicken Deluxe 6.0, Quicken Financial Planner®, Quicken Parents' Guide to Money®, Quicken Family Lawyer® (includes FREE TurboTax® 1996 coupon)\$79
(available only on desktop systems with Windows® 95)

HP Printer Options

- HP DeskJet 690c printer—low-cost color printing for the home, complete with cable\$349
- HP DeskJet 870Cxi printer—fast color printing for the office, complete with cable\$519
- HP LaserJet SL-FS printer—affordable B&W printing, complete with cable\$499

Options and accessories available with system purchase only.



CIRCLE 370 ON READER SERVICE CARD OR GO TO WWW.PCMAG.COM/ProductLink

EdVenture Pak

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(available only on desktop systems with Windows 95)

Display/Video Options

- 17" Hitachi® SuperScan® 1711 (15.9" display) .26dp color monitor\$150 ††
- 21" Hitachi SuperScan 2111 (20" display) .26dp color monitor\$650 ††
- Number Nine® Imagine® 128 series II video card w/4MB VRAM\$500 †††
- Number Nine Imagine 128 series I video card w/4MB VRAM\$750 †††

Millennia TransPort™ Options

- MicronDock™ multimedia port replicator: ethernet 10BT LAN adapter, SCSI-2 port, S-video and NTSC-video output, built-in stereo speakers, infrared port, headphone, microphone, line-in jacks, parallel, serial, VGA and 2 PS/2® ports\$299
- MicronExec® desktop package: matching black 17" monitor (15.8" display) with matching black mouse, mousepad and keyboard (can be used with or without MicronDock)\$799
- Motorola® Motorola 36.6 fax/modem supports regular telephone connections, cellular phones and two-way paging devices\$259
- 3Com ethernet 10BT PCMCIA\$149
- Sansone® leather bag\$99
- 2nd modular lithium-ion battery\$199
- 2nd hard drive (1.3GB)\$599
- 2nd hard drive (2.1GB)\$699
- 16MB DIMM upgrade\$349
- Car adapter\$89

Service Options

- Extended 2-year on-site service coverage for desktop systems\$99
(upgrade from optional 1-year on-site service coverage)
- Extended 3-year on-site service coverage for desktop systems\$139
(upgrade from optional 1-year on-site service coverage)
- Complete on-site PC installation (call Micron Electronics® for details)\$159

Other Options

- APC® Pw7T surge suppressor\$39
- APC Pw7T surge suppressor\$59
- Microsoft Natural Keyboard®\$49
(upgrade from standard keyboard)

- * Upgrade from systems with standard 16-bit stereo sound card
- ** Requires SCSI host adapter
- *** V.34 modem includes trial memberships to CompuServe®, Prodigy® and America Online®
- † Requires sound card
- †† Upgrade from systems with standard Micron 17" 17FGx color monitor
- ††† Upgrade from systems with standard 64-bit 2MB video card

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First Looks

Procomm Plus for Windows 95

List price: \$139

Requires 8MB RAM (16MB recommended), 45MB hard disk space, Microsoft Windows 95

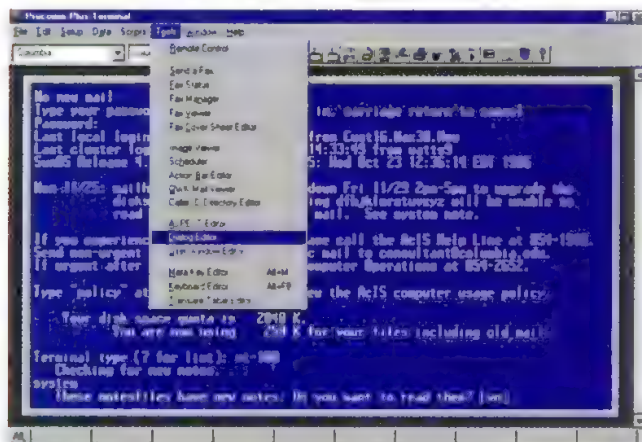
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interface lets you attach one of the predesigned cover pages or create one of your own in a supplied editor. You can also attach files and scan a document to be faxed. Received faxes can be annotated or converted to text with a supplied OCR module.

Procomm's Internet support is less satisfying. The no-frills e-mail client doesn't support message-filing rules or allow for automated responses. The news reader supports off-line reading, and it can weed out messages both those from specified individuals and those with specified text in the header. The news reader can also decode binary files, such as graphics. The included Web browser is a licensed version of Microsoft Internet Explorer 3.0, but IE's standard interface has been replaced with a confusing one from Procomm that leaves out the IE button for changing font sizes on the fly. Internet addresses in mail and news mes-

sages aren't live either, so you can't click on a URL in an e-mail message and jump to the site in your browser.

On our 100K file-transfer test, Procomm was the slowest program—by a second—of the five in this roundup, but it yielded an average score on larger files.

Procomm's Internet modules detract from its powerful terminal module, but its polished fax module will surely appeal to advanced users.

BMT Micro

ZOC

Power users in search of a traditional terminal program that's at home in the world of 32-bit GUI operating systems should look no further than BMT Micro's \$69 ZOC. The program comes in two flavors, one for Windows 95 and Windows NT, the other for OS/2 Warp. Both use IBM's REXX scripting language and give advanced users unique customizability and automation, although the OS/2 version (First Looks, April 9, 1996) is more solid than its more recent Windows sibling.

ZOC's interface resembles those of keyboard-oriented, character-based packages—such as the original Procomm. ZOC features a customizable toolbar and a button bar that can be set up to call a phone number, download a file, or run an automated script. You can use a simple, built-in scripting language in place of REXX

for recorded or programmed automated logons.

Unique automation features include a function that monitors incoming data for filenames, Internet addresses, and CompuServe IDs, and then displays them in a small window where you can select and reuse them. As you type, ZOC automatically expands abbreviations into longer strings; the program can insert your signature when you type your initials, for example. And it can automatically respond to incoming prompts with pre-set strings without running a script.

ZOC lets you set up a single phonebook entry for BBSs and other services with multiple phone numbers, and the program cycles through each number until it reaches a line that isn't busy. ZOC automatically releases the COM port for use by other software when you minimize ZOC to an icon.

Only a few basic terminal emulation modes are provided, but each is highly customizable. Zmodem and other standard file-transfer protocols, including CompuServe B+, are supported directly, but as in old-style terminal programs, you can use external modules to supply other protocols. Graphics files are displayed in a built-in viewer, and host mode is supported via a REXX script.

The program's nonstandard menu structure is at first con-

fusing, but when you select an option in the phonebook dialog box, it lets you add one or more phonebook entries to the drop-down menu. If you want to rearrange the layout of the button bar, you have to cut and paste the names and commands by hand. ZOC was a middle-of-the-road performer on our 100K file-transfer test; it struggled a bit when it came to the 1MB file test.

ZOC seeks an uncomfortable middle ground for itself: Beginners are better off with a more graphical interface and many advanced users will prefer the convenience of HyperAccess. On our tests, we had trouble getting the program to work well until we ignored the default modem-initialization string and used a simple ATZ reset command. But long-term users of character-based communications software who are willing to get down and dirty with modem-control strings will find ZOC powerful and responsive.

ZOC

List price: \$69

Requires: 4MB RAM, 2MB hard disk space, Microsoft Windows 95 or Windows NT

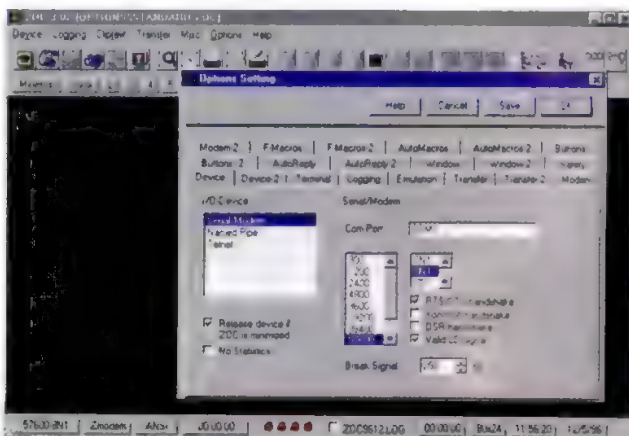
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ILLUSTRATION

One Step Forward, One Step Back

Deneba's Canvas 5 values convenience above all else, but it falls short of the mark for a do-all illustration program.—By Luisa Simone

Deneba Canvas 5 is a mix of old and new that adds up to a mildly improved illustration program, but it just doesn't cut it as a do-all image design center. The \$600 Deneba Canvas 5 package adds excellent typography, an improved vector-drawing engine, and more extensive layout options. It's designed to appeal to technical illustrators who work in digital media and need precision drawing tools.

Longtime Canvas users will be able to pick up the new tools with a minimum of fuss. The most useful additions to the program come in the form of enhanced drawing tools. For example, the new combine command performs a number of vector operations (such as intersection, addition, and subtraction) that allow you to create complex objects quickly and efficiently. Likewise, the enveloping tool (with presets for standard deformations as well as free-form editing modes) provides easy-to-achieve special effects.

One of the most serious criticisms of earlier versions of Canvas concerned its lack of typographic controls and text tools. The dramatically improved text-handling functions bring Canvas up to snuff as a multipurpose design and layout program.

There's support for named styles for paragraphs or characters, a spell-checker, interactive tabs on the text ruler, and automatic drop caps. And Canvas added precise control over kerning, hyphenation, widows, orphans, and text flow. All told, these additions make Canvas suitable for short, moderately complicated desktop-publishing projects. There are a few irritations, however. The most annoying is the program's inability to select text across linked text

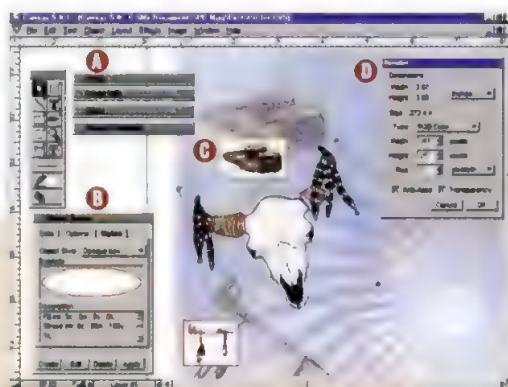
frames. And Canvas forces you to select each text frame and the associated graphic in order to generate wraps.

Canvas boasts an integrated working environment where a remarkably consistent interface gives you access to 2-D vector, 3-D modeling, and an extensive array of bitmap-editing tools. A single click provides object-level functions (such as rotation and skew), while a double click provides curve- and node-editing functions (for vector objects), extru-

CUSTOMIZE: *Canvas has a graphical toolbox that is overflowing with useful features.*

A Roll-up palettes provide access to object-management tools, formatting options, and special effects.

B You can save object-level formats for fill, stroke, and line color using the new Object Specs roll-up.



C When working with the painting tools, you can now paste selections into a composition with varying degrees of transparency.

D You can easily convert vector drawings into bitmapped images. Vector backgrounds can be converted to a bitmapped selection mask.

sion and lighting options (for 3-D objects), and pixel-level functions (for raster graphics).

Unfortunately, a lack of power is the price you pay for such convenience. Canvas provides a broad range of only the most basic, graphically oriented functions. It doesn't offer the state-of-the-art functionality found in competing products, such as CorelDraw, Graphics Suite 7, or the upcoming Freehand Graphics Studio 7.

Canvas's new image-editing functions are a case in point: You can import a bitmap file, acquire a Twain image, or create

an original raster painting—all from within Canvas. The image-editing tools allow you to perform such fundamental operations as adjusting the dynamic range or changing the color balance of a picture. In addition, a modest selection of filters can sharpen or blur a picture, add or remove noise, and even deinterlace a video image.

Many sophisticated functions are either not provided by

distribution on the Web, you can't take advantage of advanced features supported by these formats—transparencies and interlacing, for example. Likewise, Canvas supports the Adobe Photoshop plug-in specification but not the newer vector-effects plug-in specification, which could have raised the program to a higher level.

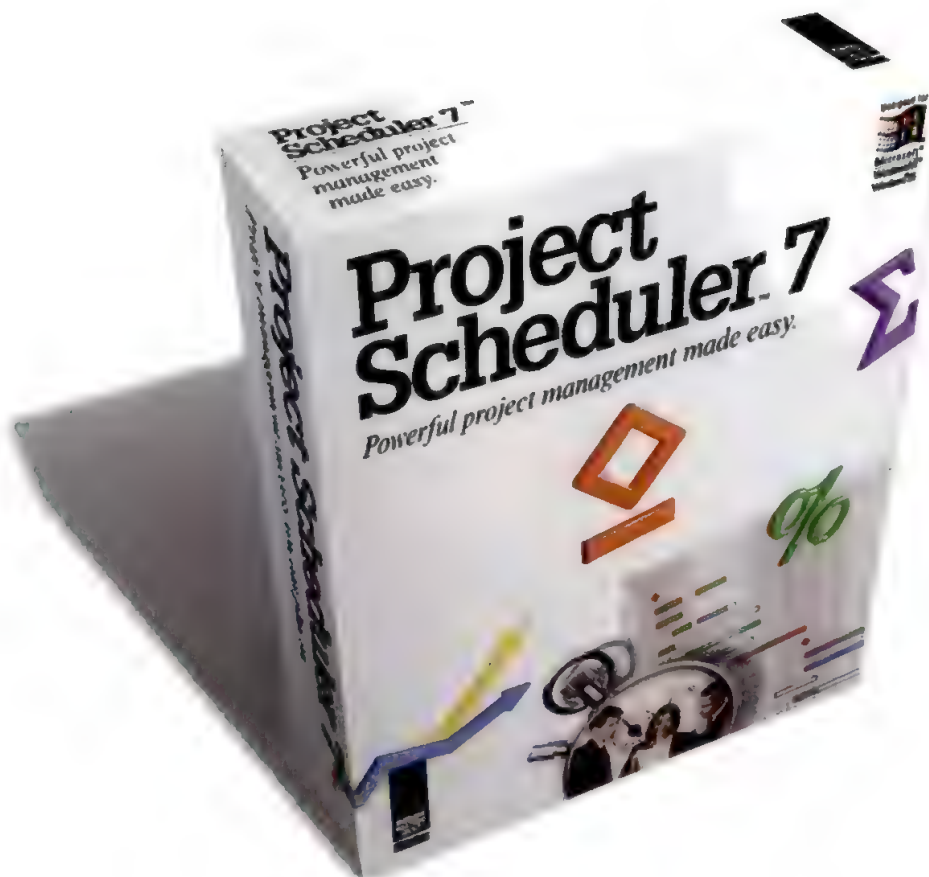
Canvas's new presentation functions, which supplement its illustration and desktop-publishing document functions, suffer from the same kinds of intrinsic limitations. Essentially built around drawing layers, Canvas presentations can include progressive builds and transition effects but not much more. The program doesn't offer an outliner, can't incorporate multimedia objects, and has no run-time player.

We reviewed Canvas 5.0.1, which is a quick update to the original release. Despite functional improvements to various tools, we still experienced several crashes when working with Canvas. Our biggest problems occurred when we were manipulating text objects. Expect Deneba to iron out the remaining wrinkles in Canvas over the coming months.

Canvas would like to be the Swiss Army knife of graphics programs by providing a wide variety of tools in one small package. But at \$600, this upgrade will appeal more to dedicated Canvas users who need to expand their graphics toolkit with minimal image-editing and presentation functions than to prospective Canvas users.

Canvas 5.0.1. Street price: \$600. Requires: 8MB RAM (16MB for Windows NT), 35MB hard disk space, Microsoft Windows 95 or Windows NT. Deneba Software, Miami, FL; 305-596-5644; fax, 305-273-9069; www.deneba.com. Circle 402 on reader service card.

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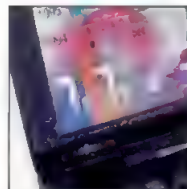
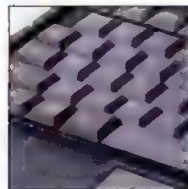
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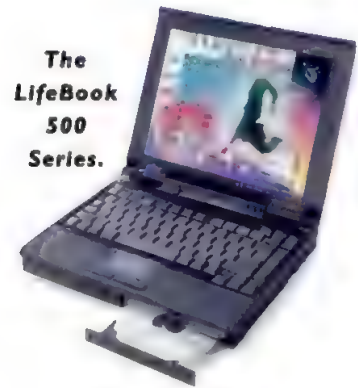
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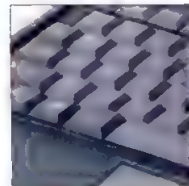


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Designed for

Microsoft®
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First Looks

UTILITIES

New Features, New Power, New Risks

Norton Utilities 2.0 gives users enough control to get out of—or into—trouble.—By Edward Mendelson

Unless you like playing with fire, you'll want Norton Utilities 2.0 on your Microsoft Windows 95 system. Symantec's \$80 comprehensive package is half as expensive as its predecessor. This version adds virus-scanning and advanced registry-editing tools to the classic and indispensable Norton Disk Doctor (NDD) as well as an array of programs for maintenance, tune-up, and emergency recovery.

If you recently bought a new PC, your copy of Windows 95 may have the new FAT32 file system installed. While other programs can demolish a FAT32 system while attempting to repair your hard disk, the new version of Norton Utilities contains the only programs that can repair it.

The program's new Registry Tracker records all changes made to the system's registry file, either in the background or on command. The Rescue utility stores a variety of recovery files on floppy disks that you can use to restore your system in case of emergency. Unfortunately, if your registry file doesn't fit on a single floppy disk, instead of splitting the file between two floppy disks, Norton Utilities saves it to the hard disk—where you may not be able to find it after a disaster.

In expert hands, the new Registry Editor offers unparalleled convenience in cleaning and repairing the Windows Registry. Unlike Windows' bare-bones Regedit program, Registry Edi-

tor can both search and replace, and it displays the results of its high-speed searches in a separate pane, like the file finder built into Windows 95.

Norton's Registry Editor is not a one-trick pony; it can also edit SYSTEM.INI and WIN.INI entries. All actions performed can be reversed, and the program works with Registry Tracker to let you return to a previous version of any of your system files.

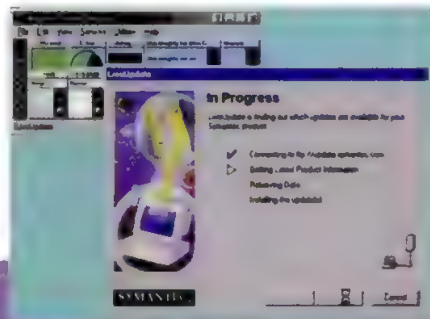
Norton Disk Doctor continues

ety of automated features. An improved Norton Companion program on the CD-ROM provides a useful introduction to the technical details of disks, memory, and Windows 95.

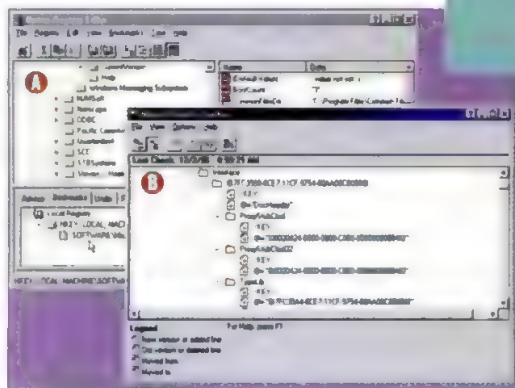
A nice addition to this version is that System Genie offers to stop Windows 95 from adding a tilde and number to every DOS-style short filename that Windows creates when you save a file with a long filename. Genie, however, seems unaware of the

results in hundreds of files being dumped into the wrong directories and renders any programs ever run from an OS/2 desktop unusable. NDD's undo feature can restore the disk, but unless you know that the program was creating errors instead of correcting them, you may wind up formatting your disk and restoring from backups.

Other problems were less traumatic: the DOS-based Norton Diagnostics program reported that our 200-MHz Pentium Pro test system was a 225-MHz Pentium system—a CPU that doesn't exist—and thought our standard 101-key keyboard was an 84-key model. And the CrashGuard program, which is not automatically installed with the other utilities, blocks general protection faults, but like all similar programs, it can't



AUTO-UPDATE: The LiveUpdate feature downloads program fixes and updates (above). In the right hands, Registry Tracker and Registry Editor are powerful system tools(left).



A Registry Tracker monitors and records changes to the Registry.

B Registry Editor lets you search for and bookmark text strings.

to check for major and minor disk errors and can repair many of the problems it encounters. In addition, NDD now can handle large fragmented files with aplomb. The Protected Recycled Bin—which temporarily warehouses files deleted from the DOS prompt for immediate recovery—is essentially unchanged from the previous version and is a must-have feature.

The disk editor is the only low-level sector-editing tool that safely modifies directories on a system with Windows 95 installed. Advanced users will be delighted with its clear interface and vari-

ously known fact that if you prevent Windows 95 from adding these elements to filenames, the installation programs of many applications place files in the wrong directories and render the applications unusable.

One of our favorite features of this version is LiveUpdate, which connects you with Symantec's Web site to download program updates and bug fixes automatically. For example, we uncovered a major flaw in NDD that has since been corrected via LiveUpdate. The bug caused serious problems on systems that once had OS/2 installed.

Because OS/2 writes directory entries in ways that aren't officially recognized by Windows 95, NDD mistakenly reports these entries as invalid and offers to remove them. This bug

prevent blue-screen crashes. Finally, a feature that locates potentially removable orphan entries in the registry file can remove entries that point to CD-ROM drives, even though some CD-ROM applications run only if those entries are present.

The unerase feature, Disk Doctor, and disk editor—the most important programs in Norton Utilities—have no competition, so advanced users have no choice but to buy a copy of Norton Utilities. Except for a few caveats, Norton Utilities is now more than ever the one indispensable utility for any Windows 95 PC.

Norton Utilities 2.0 for Windows 95. Street price: \$80. Requires: 8MB RAM, 31MB hard disk space. Microsoft Windows 95. Symantec Corp., Cupertino CA; 800-441-7234, 541-334-6054; www.symantec.com. Circle 406 on reader service card.

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UTILITIES

Big Brother Is Watching Your PC

Who's at their desks, who's in the bathroom, and who's out to lunch? These four electronic in-and-out boards let you keep track of the entire office.—Steve Rigney

How often do you find yourself wondering where your staff is and what they're doing? Into this managerial void step four helpful electronic in-and-out board programs that to one degree or another keep tabs on your office.

We looked at the most popular in-and-out board utilities, including TEAMaker Corp.'s Office Hours for Windows, IDP Corp.'s StatusView, Touch N' Go Systems' Touch N' Go, and Futurus Corp.'s Where-Abouts. These products differ in scope and features, but they each allow you to keep track of people in your business. All are fairly basic Microsoft Windows utilities that work across common networks.

In-and-out boards, like network-scheduling products, are not telepathic: They work only if all members of an organization use them all the time. This means that all employees—from the CEO to the receptionist—must log out whenever they go somewhere and log back in when they return. To make this happen, the program needs to be extremely simple to use and provide the necessary information visually.

Ranging in price from \$2.50 to \$30 per user, these programs are not expensive, and each has a particular focus. Touch N' Go is the easiest to use, while Where-Abouts provides such a wide variety of monitoring features that the program borders on being intrusive. Office Hours has an easy-to-swallow price and provides all

the basics; StatusView can keep the office's PCs in sync. You're sure to find that one of these products helps you get a handle on your employees.

TEAMaker Corp.

Office Hours for Windows

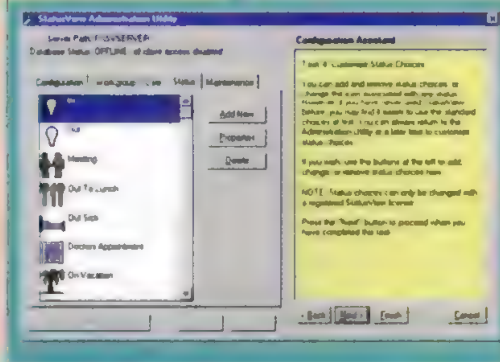
Office Hours for Windows provides a near-comprehensive view of the office's inhabitants, and at \$150 for 50 users it's a bar-

doesn't show up on the taskbar; the only way to find it is to use hot keys to switch between different applications.

The in-and-out board has eight status markers, including in, out, on vacation, and at lunch. To these you can add your own, but you are limited to a total of ten different settings. Office Hours also includes a simple calendar for company events and a well-designed utility to search for all company

► ELABORATE TO BASIC:

The TNG administration utility lets you easily add, change, and delete user information, and you can keep the smaller display in the corner of your screen.



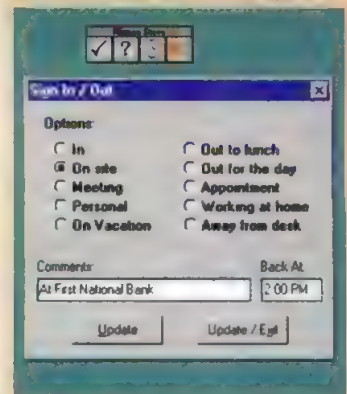
◀ MANY FROM ONE:

The StatusView administration utility lets you set up multiple status choices for your users to choose from.

client. The technical-support employee could then use a pull-down menu to select the individual job code and key in the amount of time it took to complete the call. Creating the needed job codes can, however, be difficult and time-consuming.

Office Hours' lack of password protection (or any type of security) and its inability to syn-

▼ **BIG OR SMALL:** After you've configured Office Hours, you can use its convenient Mini Display



chronize time among workstations weaken an otherwise well-executed program. But if all you want to do is track employees, Office Hours does the trick. **Office Hours for Windows.** List price: For 50 users, \$150. Requires: 8MB RAM, 3MB hard disk space, Microsoft Windows 3.x, Windows 95, or Windows NT. TEAMaker Corp., Beaverton, OR; 503-520-5050; fax, 503-626-2333; www.teamaker.com. Circle 412 on reader service card.

gain. But the program lacks significant security features.

Office Hours includes four modules: the basic in-and-out board, an employee browser, a time card, and an events calendar. To help you access the different modules, the program provides a small, unobtrusive menu bar that you can drag to any location on the desktop. Unfortunately, the bar looks tiny, and we couldn't find a way to close the menu without using the Task Manager. Furthermore, the Office Hours menu

employees and their locations.

You can install Office Hours as a standalone utility on a single PC or on a network for multiple users. It was extremely easy to install, and the small manual provides detailed steps for setting up users, status locations, and jobs.

Office Hours' time-card module lets you set up job numbers for all of your business tasks and keep track of what an employee has been doing. For example, we configured the system to handle technical-support calls with a different code number for each

IDP Corp.

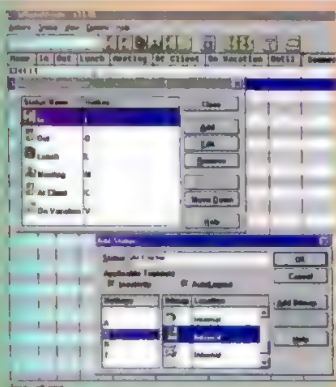
StatusView

StatusView does all the expected in-and-out board chores, and it can synchronize the clocks of all workstations on your LAN.

StatusView retails for \$249 for a 50-user license, but you can try out a free version from the company's Web site. This trial copy is not time-limited, but it lacks security features and the ability to print reports and change status choices. It's also limited to 20 users and 2 workgroups.

StatusView is a snap to install, which is fortunate in light of its basic manual. The program uses a Microsoft Access database to keep track of everyone's status and to send secure messages over the network. There are utilities that allow you to optimize the database, but you have to shut the database down every time you perform such maintenance tasks as adding a new status choice.

One StatusView feature that's



▲ **QUICK-CHANGE ARTIST:** WhereAbouts lets you add a new employee or delete one who's recently left.

lacking in other programs is the relative-time reference module, which allows you to indicate that you'll be back after a period of time has elapsed rather than at a specific time. But in order for it to work, everyone's system clock needs to be set to the same time—a rare event on a large LAN. StatusView provides a clock-synchronization feature that works with Windows NT and NetWare networks and automatically sets all system clocks to the time on the file server.

The program's ability to leave messages or sound files playing on the systems of people who have gone out can be a big time-saver. In addition, StatusView includes basic e-mail functions: You can send secure messages (but not attachments) to individual users and groups. This makes StatusView not only a good in-and-out board program but an inexpensive e-mail system for small groups.

If you want it all, StatusView delivers.

StatusView. List price: For 50

users, \$249. Requires: 8MB RAM, 1MB hard disk space, Microsoft Windows 3.x, Windows 95, or Windows NT. IDP Corp., Raleigh, NC; 919-878-0204; fax, 919-876-1266; www.idpcorp.com. *Circle 413 on reader service card.*

Touch N' Go Systems Inc.

Touch N' Go

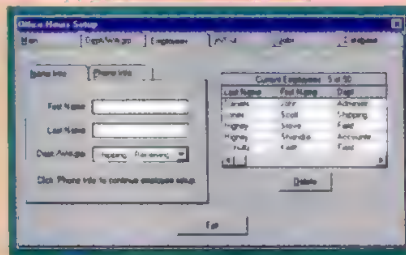
At \$250 for up-to-100 users, Touch N' Go (TNG) sets the standard for frugality and offers the most intuitive interface in this group. The program lets you see at a glance who's where and when they'll be back, and it has basic security for users and groups.

Like StatusView, TNG uses a common database stored on your file server. The TNG installation routine requires installing

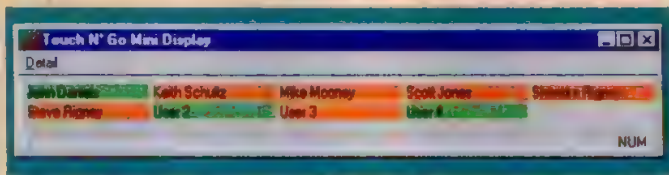
desktop, as a MiniDisplay. To change your status, you simply use your left and right mouse buttons to choose from in, out, or unavailable and then select from a list of predefined locations. You can also easily switch among the TNG screens for different departments in your company. TNG allows you to view, print, and export detailed reports on the comings and goings of individual users or groups.

Although TNG is probably the easiest in-and-out board to use, there's no way to notify a user when a coworker returns. TNG also lacks a time-synchronization feature, so you need to make sure that all system clocks are set to the same time. Nevertheless, Touch N' Go is more than a pretty face, and it provides a good way to monitor employees.

► **JUST RIGHT:** Office Hours' set-up screen gives a wide assortment of configuration options for employees and their departments.



▼ **TINY TIM:** Touch N' Go's Mini Display can show you who's where at a glance.



the server to a shared directory and installing the client software on each PC. While the installation is easy, setting up users can be a bit confusing. The administration user menu allows you to add users by typing in their names and the groups they belong to, but setting up user passwords can be awkward.

The main screen includes columns for user names, in-and-out times, remarks, and return times. The user name is highlighted in green, yellow, or red to represent in, in but unavailable, or out, respectively. TNG is the only product we reviewed that forces users to enter a return time.

You can view the TNG menu as a full screen or, if you want to perform other tasks on your

Touch N' Go. List price: For 10 users, \$250. Requires: 8MB RAM, 5MB hard disk space, Microsoft Windows 3.x, Windows 95, or Windows NT. Touch N' Go Systems Inc., Anchorage, AK; 907-264-6333; fax, 907-274-9493; www.touchngo.com. *Circle 414 on reader service card.*

Futurus Corp.

WhereAbouts

WhereAbouts offers the most flexibility and power of all the products in this roundup, but at \$750 for 25 users it's also the most expensive. WhereAbouts has customizable status changes and icons, detailed user information, and the ability to monitor users by e-mail. But the pro-

gram is less than intuitive for daily use and borders on being bothersome.

WhereAbouts is a useful utility for finding people. The program's Auto-Stat Sensor determines whether users are in by checking to see if their PCs are on and how long it's been since they've been used. Users who don't type anything or move their mice for 15 minutes get a beep and a message from WhereAbouts. Those who fail to acknowledge the message after a set period of time have their status changed to inactive. This is a powerful feature for employers but a potential threat to personal liberty.

The WhereAbouts interface is not very intuitive, and you'll probably need to read the manual before you learn to use the program's menus. Our biggest concern with the product is that it took 5 minutes for the system to register a status change when we signed on and immediately changed our status to out. Alternatively, you can hit the refresh command to notify the system of changes. Futurus is working to decrease the program's refresh time.

Two other powerful features of WhereAbouts are the trace and monitoring utilities. You can use the trace feature to flag users; when they return to their desks, they receive a pop-up message that you're looking for them. The monitoring utility lets you see everything users do on their PCs. If you have an e-mail system installed, such as Lotus cc:Mail or Microsoft Mail, the monitor utility sends you an message every time users change their status.

Powerful, but slow, WhereAbouts can track all of your employees' steps.

WhereAbouts. List price: For 25 users, \$750. Requires: 4MB RAM, 1MB hard disk space, Microsoft Windows 3.x, Windows 95, or Windows NT. Futurus Corp., Norcross, GA; 404-242-7797; fax, 404-242-7221; www.futurus.com. *Circle 415 on reader service card.*



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- Flash BIOS for easy upgrade
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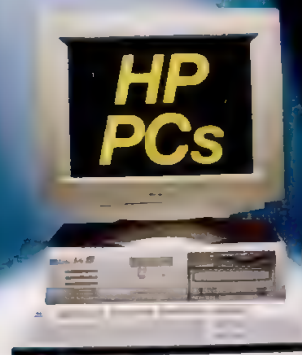


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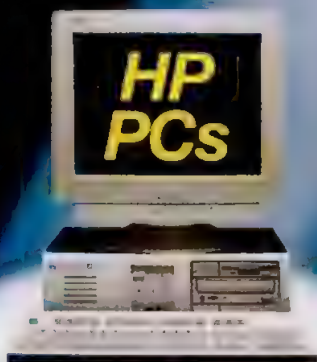
HP Vectra VA

¹In Canada, call 1-800-387-3867. *Average U.S. street price. Monitor not included. **Other capacities available. HP Vectra PCs come with MS-DOS® 6.2 and MS Windows for Workgroups 3.11, or Microsoft® Windows 95 or Windows NT included. First year, on-site, 24-hour, next day service. Second and third year, return to dealer. Microsoft, MS-DOS, Windows and Windows NT are U.S. registered trademarks of Microsoft Corporation. Pentium and the Intel Inside logo are registered trademarks of Intel Corporation. © 1996 Hewlett-Packard Company PPG430

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- Windows NT Soft Power Down
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First Looks

WINDOWS ADD-ONS

PC Power and Pizzazz

Tired of plain old Windows 95? Softscape Explorer Plus and QuikMenu 4 build better interfaces.—By J. W. Olsen

NeoSoft's \$70 QuikMenu 4 Windows 4.1b and the \$130 Softscape Explorer Plus 1.02 go where no Windows interface has gone before. Although they differ as to how they do their interface magic, they both let you set up your PC your way.

Explorer Plus is reminiscent of PC Docs and Xerox's Visual Recall but is on a smaller, friendlier scale. It gets a handle on a wide variety of documents with powerful archiving, full-text indexing, and versioning control. By contrast, QuikMenu is more akin to Symantec's Direct Access or Smart Desk's Virtual Desk, letting you create a desktop in your own image and providing notable enhancements to security.

Which one you use depends on where you want your PC to take you and how you want to get there.

application; you can even set it up to create a tabbed page for each of your Start menu program groups. Later you can modify these pages in free-form fashion, adding text, graphics, icons, and buttons.

Just about every conceivable feature is password-protectable. Along with encryption, function disabling, and limiting multiple users to authorized functionality and programs, this provides greater security for shared computers at work or home. A master password for an administrator overrides individual user settings.

QuikMenu includes several utilities that you may or may not end up using, although each has modest functionality. There's an appointment calendar and a phone book database, as well as an internal e-mail system for ex-

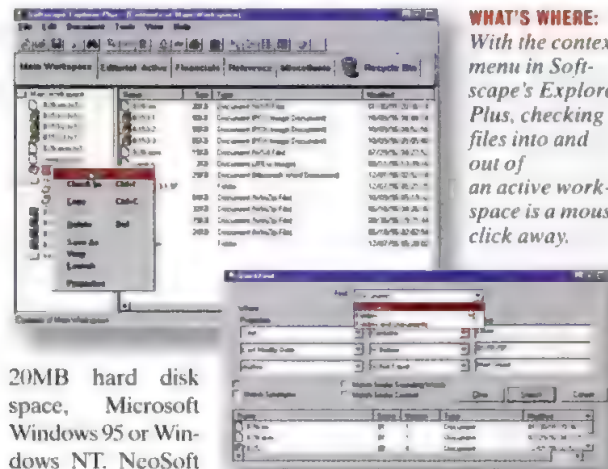
tion is partially off-screen. And DOS sessions in one virtual environment aren't always accessible in another.

If you're interested in customizing your PC's workspace, check out QuikMenu.

QuikMenu 4 Windows 4.1b. Street price: \$70. Requires: 4MB RAM,

in an active workspace is quite easy, though. You can access most functions from a right-click context menu, including the ability to view files with the INSO Quick View code.

Softscape integrates Web functionality into Explorer Plus as well, but the results are less



WHAT'S WHERE: With the context menu in Softscape's Explorer Plus, checking files into and out of an active workspace is a mouse click away.

20MB hard disk space, Microsoft Windows 95 or Windows NT. NeoSoft Corp., Bend, OR; 800-545-1392; fax, 541-388-8221; www.neosoft.com/~neosft/. Circle 409 on reader service card.

Softscape

Explorer Plus 1.02

In keeping with its name, think of Softscape Explorer Plus 1.02 as a natural extension of the Windows Explorer file system. You can import almost any kind of file into one of Explorer Plus's five workspaces or create a new file within the program. The interface uses the familiar hierarchical folder-and-file structure, so anybody who's used Windows 95 will feel comfortable.

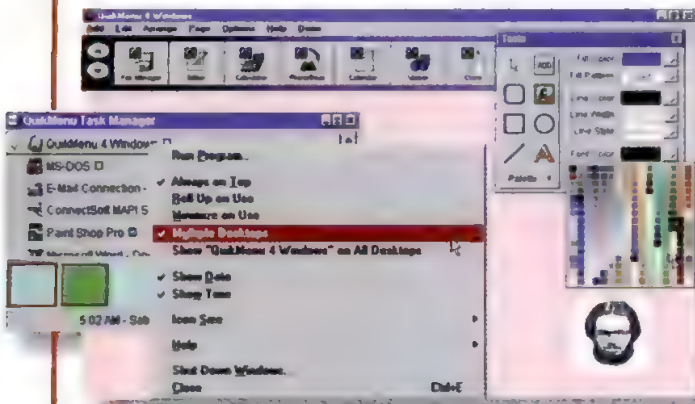
You can check inactive files into an archive, which transparently indexes and compresses them and adds version controls. Remarkably powerful searching, based on Verity's Topic search engine, uses Boolean search logic to help you locate any active or inactive document almost instantly. Unfortunately, finding older versions of a document isn't as intuitive or powerful as possible. Working with a document

satisfying. You can convert most documents into HTML format (albeit with Spartan formatting options), but unfortunately, this function didn't work reliably on our test system.

Explorer Plus exhibits some early-release rough edges: It doesn't gray out some of the unavailable menu options, and during our examination of the program, it offered to index some nontext files but silently failed to do so. And occasionally, certain search criteria failed to find files that they had previously located. Softscape is looking into these matters.

Still, if you prefer an Explorer-style environment but want more, Explorer Plus deserves consideration for its powerful searching, archiving, and compression capabilities.

Softscape Explorer Plus 1.02. Street price: \$130. Requires: 8MB RAM, 11MB hard disk space, Microsoft Windows 95 or Windows NT. Softscape, Acton, MA; 800-881-2546; fax, 508-266-0476; www.softscape.com. Circle 410 on reader service card.



HAVE IT YOUR WAY: QuikMenu 4 lets you individualize each page of your program groups.

NeoSoft Corp.

QuikMenu 4 Windows 4.1b

Setting up QuikMenu is delightfully easy, and the results are well worth the minimal effort. You can have it replace your desktop or run it as a standalone

changing messages among networked QuikMenu computers.

New to version 4.1b are its Task Manager and its five possible virtual displays, but the latter feature isn't entirely polished. With even minimal jitters when switching between virtual screens, you shift to a display in which a full-screen applica-

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- Built-in fast infrared port for easy no-cable connection to printer, PC or network
- Instant on/off for faster application access and better battery life
- Sound Blaster Pro-compatible stereo sound
- Two speakers
- Optional second battery
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Dot/Aperture Grille Pitch	0.25mm	0.28mm*	0.25mm	0.25mm*	0.25mm
Horizontal Frequency	30-115 KHz	30-107 KHz	30-95 KHz	30-98 KHz	30-86 KHz
Video Input Bandwidth	250 MHz	230 MHz	200 MHz	200 MHz	135 MHz
Maximum Resolution	1800 x 1440	1600 x 1280	1600 x 1280	1600 x 1280	1600 x 1280
Optimal Resolution	1800 x 1440 @ 76Hz	1600 x 1200 @ 85Hz	1600 x 1200 @ 76Hz	1600 x 1200 @ 77Hz	1280 x 1024 @ 80Hz
ICD Certified	Yes	Yes	Yes	Yes	Yes
MSRP**	\$2,195	\$1,895	\$1,745	\$999	\$799

*Aperture Grille



Winner
ViewSonic P815
June 1996



Winner
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A whopping 250MHz video input
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Compared to other monitors there is no comparison.

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First Looks

ILLUSTRATION

Web Special Delivery

Whether you use it for print or the Web, Freehand 7 can handle the illustrations.—By Luisa Simone

By making the most of Macromedia's Shockwave technology, the \$400 Freehand 7 package is just as appropriate for improving the delivery and viewing of graphics on the Web as it is for preparing complex print illustrations.

The key benefits are that vector files download faster than bitmapped images and Web visitors can zoom in on a vector image without losing clarity. The Afterburner utility can compress an image to less than half the size of a comparable .GIF image, and it handles the rendering of non-standard fonts by using Bitstream's TrueDoc technology. Freehand can also rasterize a vector drawing as an interlaced or transparent .GIF, progressive JPEG, or 32-bit PNG image, complete with alpha channel.

The core of Freehand's tool set is slightly different from the pre-

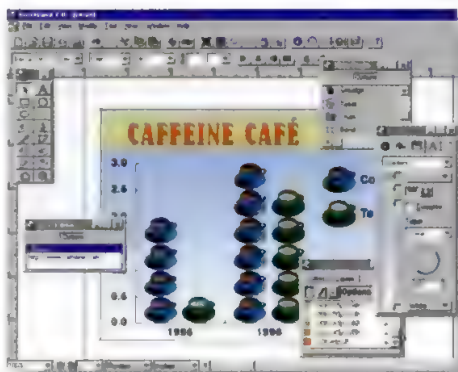


CHART A COURSE: You can use Freehand's URL editor to create interactive links that you execute with Shockwave Graphics.

vious version's. You'll now find a true multicolor gradient-fill feature and an enhanced tracing tool, which can render full-color bitmapped photographs as vector artwork with impressive speed and accuracy.

Many of Freehand's new func-

tions are implemented as Macromedia Xtra plug-in modules. You can create the illusion of 3-D objects using the blend function, which interpolates a series of source shapes and aligns the blend along a path.

Charting and enveloping Xtras let you add simple infographics and distortions to your drawings. But both tools, even in freeform mode, require an envelope using a small proxy version of your objects, and you can manipulate a maximum of eight

selection handles, which limits the variety of possible effects.

Professional illustrators will love the new management tools. For example, you can tear off or combine the tabbed palettes to customize your workspace. Xtras let you automatically name all the

colors used in a document, delete unused colors, and even find and replace object attributes, such as the number of points on a path. There's also a Java-based scripting language for automating repetitive tasks. The Kodak Digital Science Color Management System enables accurate screen previews and color (including hexachrome) separations.

At \$400, Freehand 7 is aggressively priced; we prefer Macromedia's \$449 Freehand 7 Graphics Suite (including Fontographer 4.1.5, xRes 3, and Extreme 3D 1.0). Macromedia could have integrated the suite's programs more tightly, though. And during testing we received a minor memory-error message when rasterizing a vector drawing. Freehand 7 doesn't offer all the bells and whistles of CorelDraw, but it's a very stable drawing program.

Freehand 7. Street price: \$400. Requires: 16MB RAM, 25MB hard disk space, Microsoft Windows 95 or Windows NT. Macromedia Inc., San Francisco; 800-326-2128, 415-252-2000; www.macromedia.com. Circle 407 on reader service card.

ACCESSORIES

The PC Goes Hollywood

NetTV's InstantTV can display television on your PC's monitor, and more.—By Bruce Brown

PCs that combine computing and television may be the hot ticket for new home-PC buyers, but if you can't afford a new computer, NetTV's \$170 InstantTV may be all you need. This small, gray box lets you watch cable TV, or play your VCR or camcorder on your PC's monitor. You can even play video games with InstantTV.

The InstantTV measures 4.0 by 5.5 by 6.5 inches, can stand horizontally or vertically, and runs on a pair of AA batteries; it comes with an AC adapter. You don't have to give up your couch potato habits, because the InstantTV comes with an infrared

remote control.

After connecting a coaxial video cable or S-VHS input to the InstantTV, you attach a VGA pass-through cable with leads that connect to your computer monitor and video card. This cable also has jacks for composite video and stereo audio input. There are audio jacks for line-in, line-out, and speaker-out, plus a composite video output jack.

There are several ways to use the InstantTV. In the simplest setup, you plug a cable TV line into the InstantTV's coaxial jack and connect the InstantTV's line-out jack to your audio card's line-in jack. This allows you to display

television on your monitor and play audio through your computer's speakers. If you want to watch TV without having to turn on the computer, you can either plug the speakers into the InstantTV's line-out jack or use a Y connector.

Throughout our evaluation, the system's picture quality was excellent and rivaled that of conventional standalone TVs. But in test installations, audio hookups sometimes required jack adjustments or volume synchronization. The included software switches modes easily and controls the television via the PC keyboard.

Unlike full-fledged PC/TV systems (such as the Gateway 2000 Destination, the Toshiba

I WANT MY PC/TV: NetTV's InstantTV can display television on your PC's monitor.

Infinia 7200, or NetTV's WorldVision), this product doesn't let you display a TV signal in a small window while you work with the PC. But if all you want is basic TV functionality for your monitor, NetTV's Instant TV is the way to achieve it.

InstantTV. List price: \$170. Requires: 4MB RAM, 4MB hard disk space, VGA or Super VGA monitor, speakers, DOS 5.0, Microsoft Windows 3.x or Windows 95. NetTV Inc., San Rafael, CA; 800-440-6388, 415-499-1021; www.net-tv.net. Circle 408 on reader service card.



**WARNING: CONTENTS OF THIS STUDY
WILL CAUSE FLOWCHARTING EUPHORIA**

In an independent usability study just completed, Micrografx® FlowCharter® 7 was easier to learn, easier to use, and up to 100% faster than Visio®. In fact, every single user preferred FlowCharter 7 to Visio in these areas. Jeff Schueler, President, Usability Sciences Corp. said, "It is rare to see a product outperform a competitor as significantly as Flow Charter did



Formerly ABC FlowCharter

in this study, which focused on working with process flow charts and multipaged diagrams. Users were more productive, more satisfied and preferred Micrografx FlowCharter over Visio by a wide margin." For a summary of the study results and a trial CD, visit www.micrografx.com/getresults or call 1-800-424-9751. (You can even ask Visio for the study. We sent them a copy too).



MICROGRAFX
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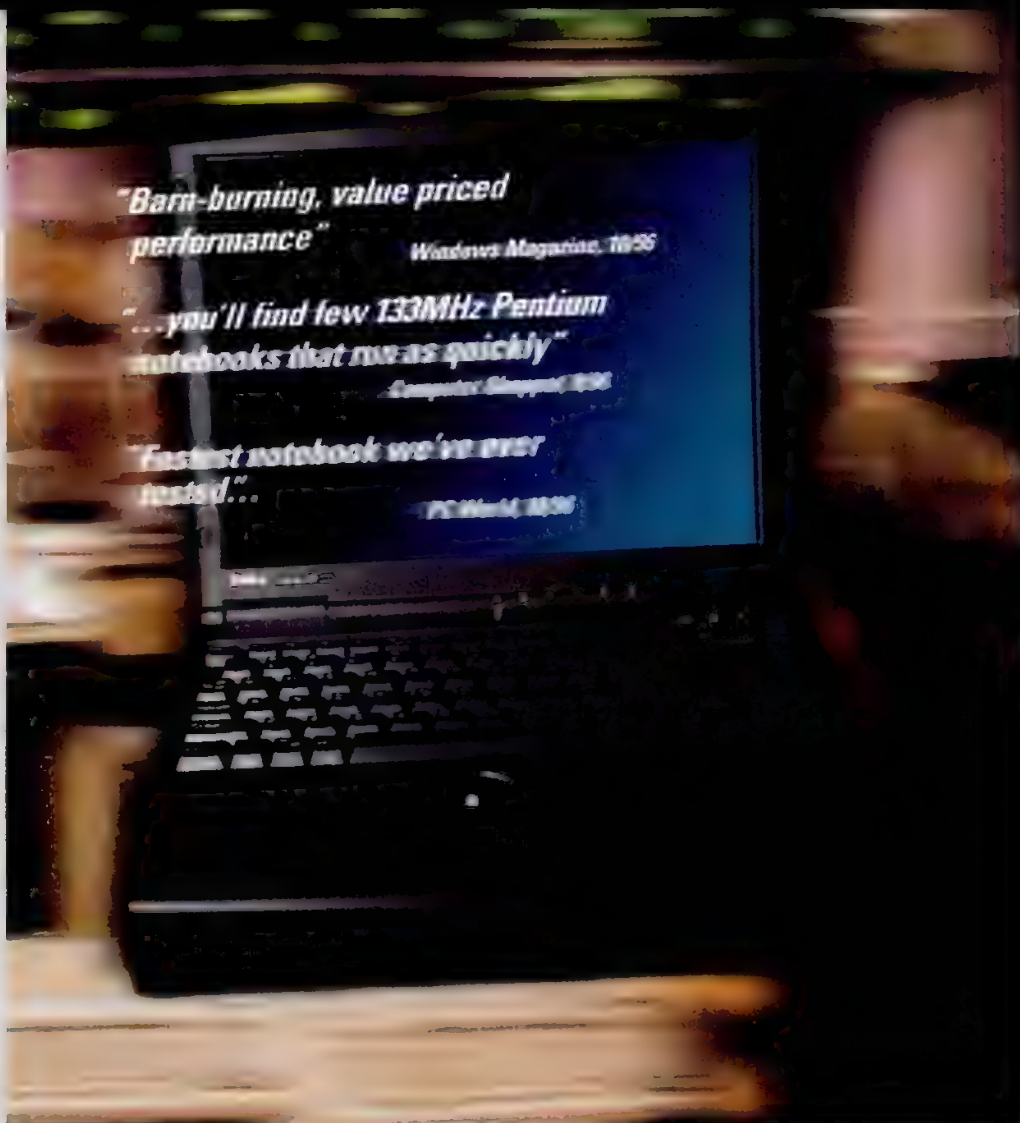
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First Looks

MAPPING TOOLS

Never Get Lost Again

Compass 3800 is the premiere package for business mapping applications.—By Bruce Brown

In the continental United States, there are 17 million miles of street, and Chicago Map Corp. can help you get a handle on them. The \$290 Compass 3800 bundle includes Precision Mapping 2.0, Compass 1.2 GPS software, and a Garmin 38 hand-held GPS receiver. Precision Mapping 2.0 allows you to annotate and customize street-level maps using standard drawing and painting tools. Compass 1.2 works with standard GPS units to track your exact position.

Precision Mapping lets you quickly obtain street-level information on places or regions within the continental U.S. by zooming in and out using keys, icons, or mouse clicks. There are 16 zoom levels from 500 miles to 0.05 miles. You can search by area code, ZIP code, city or

place name, street address, and latitude and longitude.

Unlike other street-level products—such as TravRoute Software's Door-to-Door—that are designed primarily for trip planning, Precision Mapping allows you to customize maps. You can add text and insert lines, circles, arcs, rectangles, and polygons. The program also includes a library of commonly used symbols, such as construction workers and utility poles. Custom text and art is contained in a map overlay that can be saved as a separate file.

Compass 1.2 uses the same map data but a significantly different interface. On the left side of the screen is a replica of the GPS reader and its LCD panel showing the current GPS position, bearing, speed, time, and

date. On the opposite side is a map indicating your position. As you travel, Compass leaves a trail of marks on the map, with bearing and speed displayed continually. Altitude is displayed as well, but hand-held GPS altimeters aren't very accurate.



YOU ARE HERE: Compass 3800 uses a GPS receiver to show exact position, direction, and speed.

The Compass 3800 competes with a less expensive bundle from DeLorme known as TripMate (First Looks, January 21, 1997). That \$150 package includes a rudimentary 12-channel GPS reader and DeLorme's updated Editors' Choice-winning Street

Atlas USA. The advantage to Compass 3800 is that its Garmin GPS 38 receiver has its own LCD readout and can be used as a standalone device for hiking and similar activities. You can even save a journey's data, then connect to your PC and download it to

Precision Mapping to see where you've been.

Compass 3800 won't plan a route for you or help you find lodging, but for street-level business applications, Precision Mapping 2.0 and Compass 1.2 give you plenty of power and flexibility.

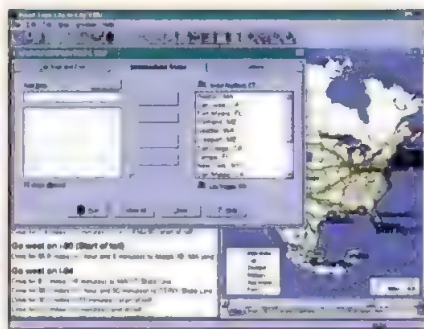
Compass 3800. Street price: \$290. Requires: 8MB RAM, 5MB hard disk space, Microsoft Windows 3.x or later. Chicago Map Corp., Lemont, IL; 800-257-9244; 630-257-7616; www.chicagomap.com. Circle 403 on reader service card.

No Trip Too Tough

The mapping and travel planning software road is becoming more and more congested. But TravRoute Software's \$40 Road Trips City to City, 1997 Edition is a road atlas and trip-planning software package that doesn't get stuck in traffic. An easy-to-use package, City to City can download destination information and road conditions from the Internet, and it features a unique round-trip optimizer, which makes it a good travel companion for frequent travelers.

If you have 40MB of free hard disk space, you can load the entire City to City program on your hard disk, which is the fastest way to run the program and a boon for users who prefer to travel without a CD-ROM drive. Other options let you install the program using either 1MB or 6MB of hard disk space, but you'll need the CD-ROM to use the program.

City to City features maps covering the U.S., Canada, and Mexico, with 12 zoom levels. City to City doesn't have the detailed street-level features of TravRoute's Door-to-Door program, but it's fast and flexible. Like other programs, City to City lets you con-



STATION STOPS: Road Trips City to City, 1997 Edition makes it easy to plan trips with multiple stops and optimize a journey.

figure map features, set travel speeds, and select the quickest or shortest route.

A trip can have as many as 13 intermediate stops, making it ideal for frequent travelers who arrange trips with numerous stopovers. Ordinarily intermediate stops are routed in the order they're entered, but if you optimize a trip, the stops are ordered using your trip preference selections. To put the program to the test, we entered a 41,916-mile road trip with 15 stops. When we ran the optimization, City to City reduced the trip to 7,383 miles.

City to City doesn't include as much local destination information on CD-ROM as the competing programs from

DeLorme, Microsoft, and Rand McNally (First Looks, November 5, 1996), but by accessing TravRoute's Web site (www.travroute.com) from within City to City, you can point to a location and retrieve lodging, dining, and attraction information, as well as weather and road construction updates.

If you travel frequently and need help routing multiple stops, Road Trips City to City, 1997 Edition is just the ticket.—BB



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At Compaq, we haven't forgotten what you look for in monitors. Still, we think there should be more to them than just sharp, crisp images (not that there's anything wrong with that). Which brings us to our new line of monitors.

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they've been engineered through and through to the same high standards that have made our PCs among the best on the planet. Which is why the line features a complete range of innovative monitors. Everything from a value series — including our V50 15" (13.77" viewable) — to high-performance models like our QVision 210 21" (19.5" viewable).

Of course, there's also our P70, a 17" (15.68" viewable)



The Compaq V70 monitor won both the PC Magazine Editors' Choice award and the Windows Magazine Best award in October 1996. The Compaq QVision 210 monitor won the PC World Best Buy award in January and November 1996. * When used with Compaq CPUs which feature Intelligent Manageability. ©1996 Compaq Computer Corporation. All rights reserved. Compaq registered U.S. Patent and Trademark Office. QVision 210 is a trademark of Compaq Computer Corporation. Other products mentioned may be trademarks or registered trademarks of their respective companies.

P70



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First Looks

DATA MODELING

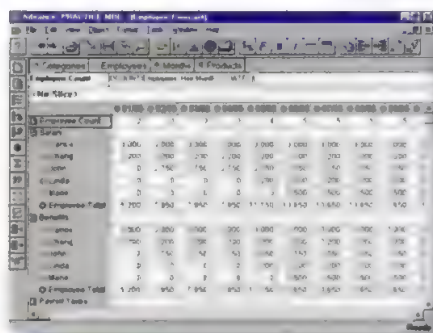
Smarter Spreadsheets

Advance provides a solid alternative to conventional spreadsheet modeling.—By Craig Stinson

Spreadsheet models are easy to build... and to break. If your modeling needs are complex and mission-critical, you should entrust them to Advance 1.1 (\$995), a new tool from Lighten that eliminates most hazards of spreadsheet modeling.

Advance models separate data from structure by assigning plain-English descriptors of any length to all modeling elements. Formulas automatically relate entire categories of information (for example, profit = income - expenses) rather than particular instances or cells. Models are thus self-documenting, and Advance makes it impossible both to overwrite formulas with data and replicate them inappropriately.

Advance also serves as a multidimensional reporting tool. Simple drag-and-drop maneu-



Category	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Employee Count	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200
Salary	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200
Profit	0	100	200	300	400	500	600	700	800	900	1,000
Income	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200
Expenses	1,200	1,300	1,400	1,500	1,600	1,700	1,800	1,900	2,000	2,100	2,200

ROBUST MODELING: Advance models represent data sheets but with plain English.

vers let you transpose information categories among row, column, and page axes. There's a multitude of views available, and each view is a named entity that exists independently of the data. A change to what Advance calls a data sheet automatically updates all views of that data sheet.

Like other spreadsheet alternatives that have come—and gone—before it, Advance uses a new vocabulary and new ways of working. Instead of spreadsheet cells, your building blocks in Advance are data sheets and lists.

Data sheets are categories of information, including those with input values and those calculated from relationships among other data sheets. Sales, COGS, and Profit are common examples of data sheets. Lists are collections of such related

items as months of the year, your company's divisions and departments, or products in a set.

Data sheets and lists are assembled into views, and a collection of views becomes a model. A model is the containing document for all work based on a common set of data sheets and

lists. Advance provides four kinds of views: folder, report, chart, and import map. Folder and report views both provide a spreadsheetlike grid of rows and columns, but report views offer formatting, filtering, and grouping options. Chart views provide graphing and import maps, which are named and reusable.

Despite its well-designed user interface and a thorough tutorial, don't expect to master this program quickly. To help you model existing data, Advance imports from dBase, Excel, Lotus 1-2-3, ODBC data sources, Paradox, Quattro Pro, and delimited ASCII files. You can map named ranges in your spreadsheet files to elements of your Advance models. Export options are limited to ASCII and .WKS, and you can export only one view at a time.

Advance 1.1. List price: \$995. Requires: 4MB RAM, 3MB hard disk space, Microsoft Windows 3.1 or later. Lighten Inc., Berkeley, CA; 800-398-4545, 510-528-4376; www.lighten.com. Circle 404 on reader service card.

INPUT DEVICES

From Pen to PC

CIC's Manta turns your PC into a jotting pad, but don't throw away your keyboard.—By Brian Nadel

In case you've grown tired of typing, CIC's \$260 mini-tablet, the Manta Handwriter, can free you from the tyranny of the keyboard. But don't expect to write the great American novel on it; the Manta makes only incremental improvements to handwriting recognition.

The Manta is a compact, attractively designed, black, touch-sensitive pad-and-pen combo that easily blends into your desktop. And at only 11 ounces, the system can easily accompany your notebook on the road. The wireless plastic stylus, which uses a pair of watch batteries, fits comfortably in the hand, and the pad's 5.3- by 4.0-inch active surface mimics the feel of pen on paper.

Plug the device into your PC's serial port, run the installation program and you have a pen-enabled PC. Once installed, the Windows pointer is replaced by a pen icon, and just about any Windows application is ready to replace keystrokes with pen strokes. You can sign Microsoft Word documents, scribble a map in Delrina's WinFax, doodle in Corel WordPerfect, and even play Hangman in Microsoft Paint.

Unlike tablets favored by graphic-arts professionals, the Manta isn't pressure-sensitive, and the pad's 410-line-per-inch resolution is better suited to handwriting, desktop navigation, and basic line art than complex

drawing and painting. Both the Manta's pen and the PC's mouse are active for maneuvering within Windows. There's a flush button on the side of the pen that activates the left mouse button, but unfortunately there's no equivalent to a right click.

After a few hours of use,



HANDS ON: The Manta tablet puts handwriting on the desktop.

we became adept with the pen. Our only reservations are that you need excellent hand-to-eye coordination to navigate through Windows' more complex pull-down menus, and in some situations the pen needs to

be nearly vertical to respond.

Handwriting recognition remains the weak link. The software's output ranged from abysmal (gibberish) to barely acceptable (about 90 percent accuracy). After about four hours of exercise and experimentation, The Manta was able to recognize much of what we wrote, as long as we wrote carefully and took our time.

On the whole, the Manta does better than its predecessors, but the device will be cherished more for its navigational abilities than for its handwriting-recognition skills.

Manta Handwriter. List price: \$260. Requires: 4MB RAM, 5MB hard disk space, Microsoft Windows 3.x or Windows 95. Communication Intelligence Corp., Redwood Shores, CA; 800-888-8242; fax, 503-639-5107; www.cic.com. Circle 405 on reader service card.

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THE CLEAR CHOICE



EDITORS' CHOICE

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Second Looks

UTILITIES

Corporate Windows Washer

If you're looking for a way to control your family's computing activities, Bardon Data Systems' WinU 3.0 is a good place to start (First Looks, January 21, 1997). Concerned parents can use the program to set up spheres of computing for their kids that include the programs they're allowed to use and excludes those they're not. And it allows parents to set limits on the amount of time a program or the entire desktop can be used.

A new update, Version 3.1, does for the business world what its predecessor did on the home front. Now in beta form on Bardon's Web site (www.bardon.com) as a free trial download,

WinU 3.1 is based on the same design as WinU 3.0.

You can set up profiles for employees based on their responsibilities. For example, there's no reason to give the security guard access to the company's confidential accounting database or to allow the receptionist to use the 3-D modeling program for the company's top-secret biotechnology virus.

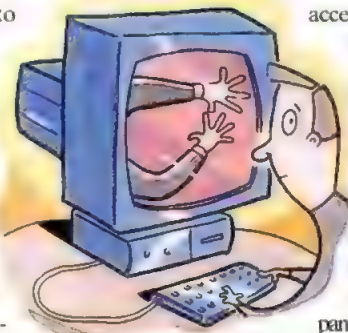
If a user tries to load an unauthorized program, WinU blocks its execution. Luckily, there's some flexibility in this otherwise airtight program. The administrator can set up a list of software that is allowed to operate on a PC, for exam-

ple, and even authorize CD-ROMs to run automatically.

A big step forward on the security front is that WinU can now disable the Delete key, preventing users from removing sensitive material from either their PCs or the network. In addition, the program can block the right-mouse-click context menus and common dialog boxes—back doors to file deletion.

The program now supports one-use passwords as well, which will likely be a boon to companies that use temporary workers. And instead of WinU's configuration and security residing locally on each PC, this data can now be stored centrally on a server and updated remotely.

Although this program goes against the spirit of computing by curbing many of the freedoms that using a PC can bring to employees, WinU 3.1 may mean that systems administrators sleep a little easier.



MONITORS

Full Resolution Ahead

The integration of a TV tuner, speakers, and control screen in the Editors' Choice-winning Toshiba Infinia 7200 set the standard for other home PCs to match (First Looks, October 22, 1996). The system's monitor is capable of displaying PC resolutions of up to 1,280 by 1,024 pixels, although configuring the system for full resolution wasn't exactly easy.

The 7130 and 7160 models of the Infinia do not require special treatment for high-resolution operation. But because the Infinia 7200's TV tuner raises the refresh rate from a default setting of 60 Hz to 75 Hz, you need to ignore most of what you know about changing graphics settings in Microsoft Windows 95 and follow a special procedure.

Start by pressing the F8 key when you boot up the system. This brings up the boot selection list; select Safe Mode, which loads the minimum dri-

vers needed to run the PC.

Next, select Control Panel in the Settings sections of the Windows Start menu. Finally, in the Display tab, choose S3 Refresh and select 60 Hz in the 1,280-by-1,024 refresh rate pull-down menu.



You should now be ready to run at full resolution. Every time you use the TV portion, though, the Infinia reverts to 75-Hz operation, and you have to start all over again.

CD-ROMs

Big Ticket Gets Bigger

Microsoft Cinemania 96 may be "the best movie reference around," as we said in our initial review of the CD-ROM ("Top 100 CD-ROMs," September 24, 1996), but new movies are released all the time, and CDs quickly get as out of date as an issue of *Premiere*.

Microsoft resolves this timeliness issue by mating the CD-ROM with the Internet and your PC's hard disk, bringing fresh information to a screen near you. The download page of the company's Web site (www.microsoft.com/msdownload) provides monthly Cinemania up-

dates that supplement the CD-ROM's content. The updates go back only as far as August for Cinemania 96 and July for Cinemania 97.

Each 1MB update includes reviews of about 20 new films. Unfortunately, none of the photos or clips, which are standard fare on the CD-ROM, are included in the online updates. But whether the content is on your hard disk or the CD, it looks the same.

So if you're looking for the lowdown on "The First Wives Club," "2 Days in the Valley," or "The Stupids," Cinemania is your ticket to the stars.

SECOND LOOKS MAILBOX: Tell Second Looks about your experiences with computer products. Contact Brian Nadel via MCI Mail (556-1500), CompuServe (72241,1616), or the Internet (bnadel@zd.com).

New Microsoft Team Manager 97

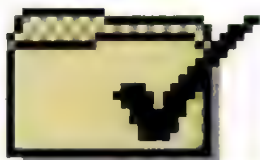
is the kind of manager you'd be
an additional 16

The screenshot displays the Microsoft Team Manager 97 interface. At the top, the 'Task Organizer' window shows a list of tasks with columns for Task Name, People Assigned, Total Work, Deadline, and Priority. Below this, the 'Tasks that Need Attention' window is open, showing a list of tasks with icons indicating their status. To the left of the task list is a 'Vital Signs' sidebar with options like 'Tasks with Deadlines', 'Tasks that Need Attention' (selected), 'Tasks with Unassigned Work', and 'Missing Status Reports'. At the bottom right, a calendar for March 1997 is visible, showing the days of the week and the number 1.

Task Name	People Assigned	Total Work	Deadline	Priority
Write product name summary	Lilly, Eric	2 weeks		Highest
Competitor pricing research	Jane	6 weeks		

Task Name
12 Finish first quarter projections
14 Prepare presentation for Fall sales
18 Revise current client database
19 Develop agenda for Team retreat

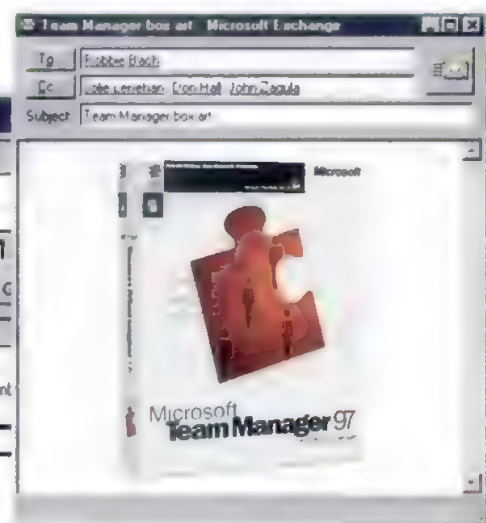
if *YOU* had megabytes of memory.



Overloaded Work	Alert	Status	Deadlines
0 days			
10 days			
0.82 months			
0.8 weeks			

▼ Missing Status Reports			
Person	Dec 96	Jan 97	Feb 97
Andree	☒	☒	☒
Barb	☒	☒	☒

▼ Performance Goals	
People	Goal
Andree	
Barb	1. Become more self-directed on projects
Eric	2. Improve working relationships with other team mem
Lilly	3. Take more initiative to improve team performance
Michelle	4. (Type here to add a goal)
Rich	
Jane	



To motivate your team and keep them in synch requires having a mind for details. A mind that can recall the status of many tasks at once. A mind that can keep track of the abilities and workload of team members. A mind that can remember the past performance of everyone in the group for meaningful evaluations. In other words, a mind that has Microsoft® Team Manager helping it. Team Manager makes it easy to keep any team working together by automatically consolidating and

tracking work by team members. The whole group can use it to get an accurate picture of team progress, what deadlines are looming and what tasks need doing. And because Team Manager is part of the Microsoft Office family of applications, your team will feel comfortable using it right from the start. Check it out for yourself at www.microsoft.com/teammanager/. You'll see how Team Manager can help you organize, motivate, track, evaluate, schedule — you know...manage.

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CIRCLE 266 ON READER SERVICE CARD

Digital Cameras Need Clearer Vision

Digital cameras are handy and fun. But in seeking the perfect balance between price and performance, manufacturers have overemphasized price. Price won't drive this market if the performance isn't there, and consumers are notoriously fussy about photographic image quality.

I've been a fan of digital cameras ever since my family took an Epson PhotoPC to Greece. It was a big hit on the trip—as much fun as a Polaroid but without the film cost, although it did mean lugging my (dear, departed) Gateway Liberty notebook everywhere and waiting on hard copies until we got home. The PhotoPC's 16-shot capacity required uploading after every historic or scenic site, and its 640-by-480 resolution meant that it was one more camera, not a replacement for a film camera. But it enabled several planned and impromptu slide shows using video projection equipment.

Color printers are certainly not preventing the success of digital cameras. Output quality in excess of 600 dots per inch (dpi) is not unusual, and new, plastic-coated papers maximize resolution and appearance. The Epson Stylus Pro and the Hewlett-Packard 693C are printers that will give you pleasing, photo-quality results at a price you can afford.

The current 640-by-480 resolution of most cameras is great for viewing your photos on a TV screen or on a monitor, where resolution is still below 100 dpi. But our expectation for paper is entirely different. Magazine photos are over 1,000 dpi, and traditional photographs exceed 4,000 dpi in apparent resolution.

At the Comdex computer trade show back in November, I made it a point to see as many new digital cameras as I could. The designers have started out with a clean slate and have left many film-oriented design precepts behind. New cameras from Hitachi, Nikon, and Sony are thin and small, the size of an elongated pack of playing cards. The Hitachi and Sony models have pivoting lenses, and the Sony DSC-F1 has a nifty infrared file-transfer feature and macro capability, too. The Canon and Epson cameras still look like point-and-shoot film cameras. The Epson PhotoPC 500 is significantly smaller and has more picture capacity than its predecessor but still has fixed focus and no macro capability.

The Hitachi is actually quite a bit more than a still camera. Not only can it store up to 3,000 JPEG images, it can also take a 20-minute MPEG movie, complete with sound.

It can also record voice annotations to its still images. Its zoom lens, however, lacks macro capability. The Hitachi has impressive menu-driven navigation features and uses a PC Card for data storage and transfer to your PC.

The Minolta Dimage V wins the weirdness award with a detachable lens that's tethered to the camera body by 1-meter-long cable. Perhaps it's actually for covert use of the camera, but it looks as though it were intended for medical procedures that shall remain nameless here. The Minolta has many desirable features, however, such as zoom and 32-picture capacity.

Although creative forces are obviously at work, I was left wanting more. More resolution. More zoom. More macro capabilities. External flash sync. Higher resolution, though, is a two-edged sword. Sure, you get better pictures, but they require more memory, and that drives up costs. The files are larger, eating up disk space and transfer time. Printing and photo manipulations, such as contrast correction, take longer, requiring faster processors.

Optical viewfinders and fixed-focus lenses fly in the face of the digital nature of these cameras, and I hope that the few manufacturers still aping point-and-shoot cameras will abandon those ideas soon. Why would you want a camera that underperforms a film-based snapshot camera in every way—but costs several times as much? With so little resolution, a zoom lens is a necessity. And a color LCD viewfinder costs no more than a

zoomable optical viewfinder.

Also, a camcorder and a Snappy give you more capability than most of the current digital-camera offerings—at some sacrifice in convenience, true, but with continuous shooting, sound, and near-infinite image capacity. A decent camcorder and Snappy still cost more than a typical digital camera, though, if you're starting from scratch.

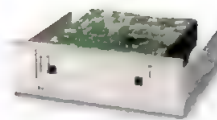
Several of the cameras I've mentioned here were unavailable for evaluation in our January 7 feature story, "Heave-Ho, Silver." But keep an eye on them, as they and their successors emerge into the marketplace. Digital photography's best years are still to come. □



PHOTO OP

The new designs are sleek, but I want more—more zoom, more macros, more resolution.

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The Perfect Palmtop

It's called Windows CE (Compact Edition), or Win CE (pronounced *wince*) for short. Exactly why Microsoft is spending time in this arena mystifies me. With today's technology, the palmtop computer remains nothing more than a gizmo carried

by a handful of business people and geeks who feel compelled to have the latest and greatest devices on the market. These people are just looking for attention.

The palmtop in various forms is nothing new, and one running Windows has no more appeal than one running the Newton OS, the Palm OS, the Wizard OS, or the Psion OS. The last one, the Psion, impresses me the most, but it's still not something I use much. A lot of people are completely in love with the Pilot from U.S. Robotics, and I suppose it's the moderate success of that machine—along with the moderate successes of the Psion, Newton, and Wizard—that led Microsoft to pursue this elusive market.

Here's my take on palmtop computing and where it needs to go to achieve true success.

First, let's consider what palmtops are good for. The primary uses of today's palmtop machine are keeping track of contacts, scheduling, calculating currency conversions, playing games, and taking notes. While some users find these functions to be a sufficient reason to own one of these things, I'm not among them.

I believe the market for palmtop machines won't bloom until additional features are added, including the ability to record voice notes, a phone dialer, an internal high-speed cellular modem, a pager, a phone, a camera, and infrared or radio connectivity. Oh, and the machine should be pocket-size. In addition, the screen should be high-resolution and capable of displaying full color. All units should have full PCMCIA capability.

Current palmtop computers offer or will offer some of these features. Philips' new Velo hand-held PC can record voice notes. The Nokia 9000 phone flips open, revealing a Psion-like computer. A future Nikon PC camera will allow you to jot notes on a touch screen. But nothing incorporates all of the features such devices need. If there were a machine I might actually try, it would look something like the Pilot, but with a flip-phone and camera built in.

The future of the keyboard on such devices is still an open question. The Apple Newton and the popular Pilot

are opting for the pure screen concept with handwriting recognition, while Casio, Microsoft, Psion, and Sharp prefer the dinky keyboard. I'd like to see all the machines offer a keyboard that you can choose to take with you or leave behind. The ideal palmtop would also have Super VGA,

keyboard, and mouse connectors, so you could turn the whole thing into a full-blown computer via a port replicator or compact docking station—kind of like a shrunken laptop.

In the future, I'd like to be able to drop the device into a CD-ROM-size drawer in my PC, where it would dock itself and open up as a volume on my system, allowing me to download notes, appointments, photos, applications, or whatever. This would also make the device more difficult to lose (I know two people who have lost Sharp Wizards loaded with phone numbers and appointments). And like cellular phones, these units should be disabled somehow when lost or stolen.

There is currently nothing like what I describe. The new devices using Windows CE are nothing new. The Geoworks OS was doing many of the same things years ago. So what is Microsoft hoping to accomplish here? Does it see some opportunity in the future? Or is this just a typical Microsoft product, developed out of paranoia? No—instead, I believe that what we are witnessing here is a new marketing direction for Microsoft. The company is finally leveraging the Windows brand name to sell more

products. Over the years, Microsoft has tried to spotlight the company name by telling people, for example, to say "Microsoft Word," not "Word." People never warmed to this notion, but they have bought into the Windows name: Windows 95, Windows NT, Windows CE, and so on.

I don't want to complain too bitterly about the current offerings. It's clear we're making progress, and these new machines will eventually lead us to the pocket computer of the next century, which I will assume will be not only more useful than today's devices but also more convenient to use. But despite Windows CE, we're still a long way from seeing any palmtop product that I'm going to rave about.



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Inside Track

They're **Baaack Dept.:** AMD executives have been flying around the country showing **secret demos of its K6** processor, which looks to be about **30 percent as fast** as a Pentium Pro at the same clock speed. More important, this chip, which incorporates MMX, appears to be the more likely candidate for chip of choice for next-generation laptops. It requires much less power than a Klamath. Intel has been **fooling** around with its Klamath design and apparently had to move the internal cache in such a way that slowed the chip substantially. This may be corrected by the time the chip ships. The first fix was to increase the chip's internal cache. Still, the Pentium Pro MMX appears to be too hot for laptop use, or so I'm told. It's getting difficult to determine fact from fiction, as AMD's powerful marketing group is putting a lot of spin on various **rumors and stories** floating around the Valley. By summertime, when PC Magazine Labs gets through testing the first batch of machines that use the newest chips, we'll know the full story.

What's Ray Noorda up to? Dept.: His new company, **Caldera**, has helped popularize Linux by reselling the public-domain Unix clone to super-hackers. Currently, the Linux community seems grouped around Caldera's and **Red Hat Software's** offerings as the two implementations of choice. But more interesting might be Noorda's purchase of DR DOS—it's about to be renamed **OpenDOS**, and the source code may be appearing shortly.

Some observers feel that all this may be part of a **plot** by Noorda to somehow get back at Gates for Microsoft's hardball business tactics. For example, I know one writer who claims that he has an original version of MS-DOS, Version 1.0, which was created by Seattle Computer Products and bought by Microsoft for \$50,000. The writer claims that if you **hit a specific series of keys**, you'll get Gary Kildall's name and some other indications that some of the code was actually lifted from CP/M. Apparently this was fixed rather quickly, and certain secret deals were made between Digital Research, IBM, and Microsoft regarding CP/M, CP/M-86, and the product that eventually became MS-DOS. Some of this information has been lost forever because of the mysterious and tragic barroom death of Kildall a few years ago. Another computer journalist, this one in the UK, believes that Noorda is hoping to get Gates into court in some way or other and that DR DOS is the key. We'll follow this as it unravels.

Hard Disks Forever Dept.: Last September marked the 40th anniversary of the first disk storage system, the

*If a virus is hidden
in a Java program
on your Web server
unknownst to you
and someone downloads
the virus, your server
can legally be the target
of a wiretap and a
search warrant.*

IBM RAMAC 305. It held something like 5MB on 50 2-foot-wide spinning platters. Now we're all using diminutive gigabyte hard disks. What's next on the horizon? 1997 will probably be the year that the MR (magneto-resistive) head drive comes of age. In two years, look for something called the **GMR head** to appear. This refers to "giant magneto-resistive" effect; it's also called a spin-valve head. It should increase data density by a factor of 10. So those 10GB disks that will be standard by 1999 will be headed towards **100GB** after the millennium.

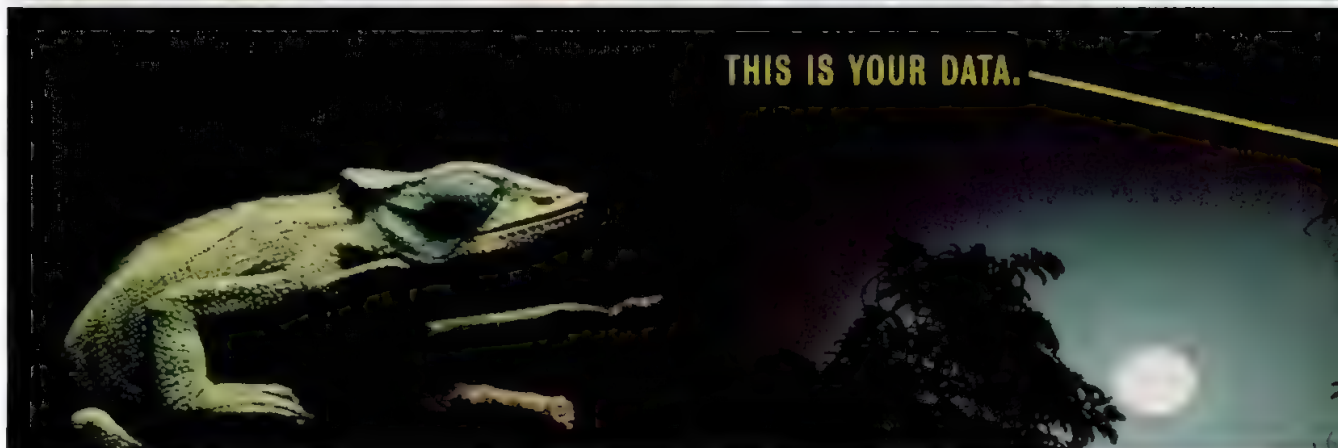
Of course, by that time all the software vendors will be pumping out code by the gigabyte on DVD disks, and Windows 2000 will require 10GB of disk space to load and 2GB

of main memory to run. You probably think I'm kidding.

While on the Subject of Hard Disks Dept.: Look for a new standard size. Between the 2.5-inch hard disk and the 3.5-inch hard disk, there is a new form factor and size, the 3-inch hard disk. This new size is being promoted by JTS (a new company formed by executives from Seagate and Tandon, among others) for use in laptops. **Keep an eye on these guys.** Also look for the 1.8-inch hard disk to head toward a gigabyte of capacity this year. Astonishing.

Some Ideas Never Die Dept.: I spend a lot of time reading trade publications from Asia trying to find design trends that may interest readers. Recently, I've noticed that an **inordinate number** of motherboard makers have begun producing processor cards that fit onto a backplane, rather than using full motherboards. In other words, you have a bus and an infrastructure into which you plug the processor board. It's hard to say how important this trend will be. Years ago, Computerland produced a branded backplane computer. More recently, the Panda Project designed an entire architecture around the backplane concept. The pro argument is that you can easily upgrade these things. The problem with this design is that it tends to be more expensive than the traditional "processor on the motherboard."

An interesting item appeared in the BNA Electronic Information Policy and Law Report (Bureau of National Affairs, 800-372-1033; \$895 per year) under the title "Computer Attacks Show New Patterns." In the report, a law-enforcement consultant describes a scenario that's enough to make your hair curl. Apparently, if a virus is hidden in a Java program on a Web page on your server **unknownst to you** and someone downloads the virus, your server can legally be the target of a wiretap and a search warrant. Worse, according to the source, the title of your computer can be transferred to the government as soon as a hacker uses it to commit a crime. Use a computer. Go directly to jail. □



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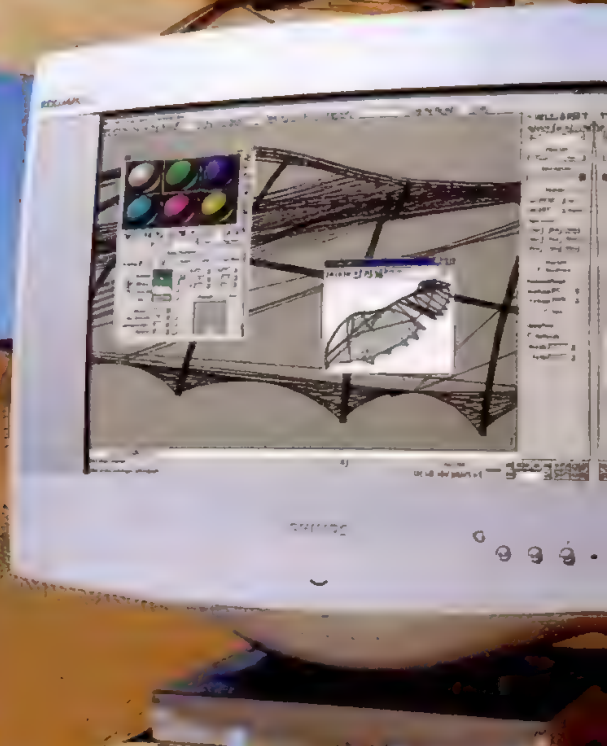
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Scanner Myths and Secrets

After moldering on the edges of the mainstream in the PC world for years and subsisting as a specialty-item category for graphic artists, scanners have recently roared to the forefront of the PC peripherals business. This move was begun, I'm

convinced, by the appearance almost three years ago of Visioneer's sensational PaperPort sheet-fed scanners, which sit like miniature paper-towel rolls between your keyboard and monitor and gobble up anything you want to reproduce, fax, run through optical character recognition (OCR), or simply save.

Although serious competitors have appeared—including the UMAX PageOffice and the Microtek PageWiz, among others—Visioneer still rules the roost in convenience, quality, and value. A good part of the magic comes from Visioneer's PaperPort Deluxe software, which for most users strikes the right balance between immediate accessibility and appropriate classification for stored material. The hardware's pretty nifty too—especially in the latest PaperPort Vx units—but the overwhelming convenience of the Visioneer integrated hardware/software solution is clearly what makes the product, and by reflection, the whole category of “convenience scanners” a winner.

But convenient as these little wonders are, they're no replacement for a flatbed scanner when what you mainly want to do is scan flat art—drawings, photos, clips from newspapers, and so on. Today, there's an amazing range of high-quality, affordable desktop scanners. Really good units are available for a quarter of what the going rate was just a few years ago, and the quality and convenience available from desktop scanners today blow away anything we had at yesterday's inflated prices.

Today, at the top, you can buy for about \$1,500 a 36-bit desktop flatbed scanner that seriously challenges the \$40,000-and-up drum scanners standard in commercial publishing. Not replace them *outright*—the \$40,000 market still has a future, not least because of inertia—but for many purposes, you can migrate scanning for quality reproduction to these easier-to-use flatbeds, which cost less than a twentieth of their high-end competitors.

Among high-quality PC scanners, the best I've used is the Microtek ScanMaker III, which has just dropped from \$2,000 to about \$1,500. With the very good ScanWizard

scanner-control software, the ScanMaker III is a joy to use. It has high (“real”) optical resolution of 600 by 1,200 dpi, and it can interpolate up to 4,800 by 4,800 dpi; maybe more important, it has a dynamic range of 3.4. A scanner's dynamic range describes how well it captures the brilliance of transparencies—from opening

up deep shadows to pulling bright highlights into the reproducible part of the gamma curve—which is especially useful, because the ScanMaker III also includes a transparency adapter. But note that although you can scan 35-mm slides on the supplied adapter, it's best used for 4- by 5-inch and 8- by 10-inch sheet film.

Your 35-mm transparencies absolutely belong on a dedicated slide scanner—of which Polaroid's new \$2,500, 2,700-dpi SprintScan 35Plus is the best choice. Scanning small transparencies on a flatbed scanner—*any* flatbed scanner—doesn't produce enough resolution in the finished scan to allow reproduction at the relatively high magnifications typically used for small originals. Intermediate-size originals, such as 4.5- by 6-cm, 6- by 6-cm and 6- by 7-cm transparencies, fall into a no-man's-land in desktop scanning. If the final reproduction size isn't large, such originals come up fine from high-end desktop scanners like the ScanMaker III. But for final reproduction at more than 200 to 300 percent, you really ought to send work out to be digitized on a traditional drum scanner. I don't know of a desktop scanner optimized for these roll-film-size originals.

Scanning art for traditional print reproduction demands high resolution, a long color palette, and a wide dynamic range. But the most popular new use of desktop scanners today isn't for work headed for the printed page but for Web pages, where relatively low resolution, narrower palettes, and more limited dynamic range work just fine. After all, if you're going to run a scanned photo through a process that reduces it to a 72-dpi, 256-color .GIF that will appear on your Web page at 150 by 200 pixels—and even if you're going to put up a JPEG in 16 million colors but still at a reasonable size and at that same 72-dpi resolution—you don't need a high-end scanner.

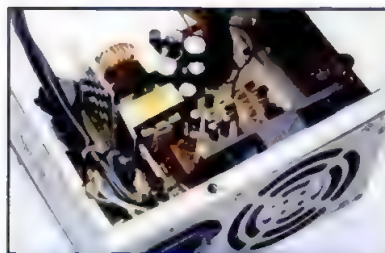


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JIM SEYMOUR

Nearly every scanner maker these days offers two low-cost models, one around \$300 on the street, and another around \$600. In the business, these are known colloquially as 3s and 6s. If you want a versatile scanner that's also able to do the higher-res work needed for print reproduction, consider one of the 6s. I think the Alfa StudioScan IIsi, the Microtek E6, Nikon Scantouch 210, and the UMAX S-12—all 30-bit units—are the best in this league, but most of the \$600-or-so flatbeds available today work well. The secret lies in the software, and here, Microtek, Nikon, and UMAX are clearly ahead—they offer the same scanner-control software with these \$600 units that comes with their often much more expensive high-end units.

But want to know a secret? You probably don't want or need one of the 6s, especially if you're mainly doing Web work. The Microtek ScanMaker E3, the Nikon Scantouch 110, and the UMAX S-6e—each around \$300—are among the best-kept secrets in the PC business. They deliver true 32-bit color in one pass, come with the same sensational software as their high-end counterparts, and provide optical resolution of 300 by 600 dpi, with interpolation up to 2,400 by 2,400 dpi. The S-6e and the Scantouch 100 go all the way to 4,800 by 4,800 dpi, though you won't want to, because beyond 1,200 by 1,200, interpolation produces no discernible improvements, just larger files.

These 3s are incredible bargains. If you've been waiting and wondering if a desktop scanner would be useful for you, here's a chance to find out without causing serious damage to your bank account.

Hot tip: If you work with images on the Web, you know how important it is to distill them down to as few colors as possible for faster downloading. The best tool I've seen for reducing the size of graphics files for Web use is ULead's sensational SmartSaver, now in Version 1.1a. SmartSaver opens a window with side-by-side views of the image—either a .GIF or a JPEG file—in its original state and in your reduced-color-palette form. Tweak to your heart's content: What you see is what you'll get. You can download a free, time-limited copy from www.ulead.com (users of ULead's PhotoImpact product, a serious alternative to Photoshop, will find the downloaded version works forever as an add-in), or you can buy and download, from the same URL, an unlimited-use standalone version for just \$29.95. A great product at a great price. □



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The PC Adviser

What's the best PC to buy? That's the most common question I hear from friends and relatives and from fellow travelers who see the *PC Magazine* tag on my shoulder bag. Fair enough. In short, you want to buy lots of CPU power and lots of memory, whether it's

for the office, a small business, or a home PC. MIPS and bits are cheap these days, so don't skimp. This isn't like buying a car, where your friends-of-the-earth neighbors might cluck disapprovingly if you want a 275-horsepower engine. Excessive PC power doesn't have any downside. Here's my take on the kind of system you should be looking at as of early 1997.

CPU. Pentium MMX or Pentium Pro? If you're running a desktop PC, if you're running mostly 32-bit applications (such as an office suite), if you're looking seriously at Windows NT, if you value the most stable operating system, then it's a no-brainer: Go with the Pentium Pro and pair it with Win NT. If you want the easiest hardware upgrades or if you're using your computer as a home PC, Windows 95, with its robust Plug and Play capabilities, has an advantage. Win 95 works best with Pentium or Pentium MMX. The only two speeds that make sense are the fastest, currently 200 MHz, and the next-fastest, 166 MHz for Pentium or Pentium MMX, 180 MHz for Pentium Pro.

As I said last issue, there's some question whether the original Pentium Classic has a place in the constellation of CPUs anymore. The extra \$100 you pay for an MMX system over a standard Pentium is cheap insurance. Already we know there's a boost of about 10 percent on all applications, thanks to the bigger internal cache, and we suspect coming graphical and multimedia applications that take advantage of the MMX's 57 new instructions could be several times as fast. If everybody takes this advice, there'll be a glut of Pentiums and a shortage of MMX CPUs. But I'm less concerned with how many MMX chips Intel can produce than by what you should be considering for your PC.

L2 cache. On the Pentium, pair your CPU with at least 256K of L2 (secondary, or processor) pipeline-burst cache and think seriously about 512K L2 cache. The extra \$50 to \$100 buys you another 3 percent on mainstream performance. Only a handful of home systems no longer have any cache. The Pentium Pro has the L2 cache built in.

RAM. You could argue long and hard about whether to install 16MB or 32MB of RAM on your PC, or if the sweet spot is

some in-between number, like 24MB. When memory costs less than \$10 per meg, the right answer is it doesn't matter. Specify 32MB for a Pentium, 64MB for a Pentium Pro. Don't bother with in-between combinations like 24MB or 48MB.

Graphics subsystem. You'll have to decide if you want an adapter targeting 3-D/gaming performance or business performance. Perhaps by year's end one card will do both superbly. Whichever way you go, get 4MB of RAM (repeat after me: "Memory is cheap"), which allows 24-bit color at 1,024-by-768 resolution. Do yourself a favor and consider only 17-inch monitors. In fact, think about 21-inch monitors. They're bulky beasts that take over your desktop, but you'll love not having to squint at the higher resolutions. Some vendors now have quality 20-inch monitors for \$1,500.

Hard disk. 2GB is the minimum these days. Give serious thought to 4GB to 6GB hard disks, especially if you'll be doing anything with a scanner or desktop publishing, or if you download files from the Internet. You can eat up space at a prodigious pace.

Bells and whistles. We're starting to see widespread implementation of Universal Serial Bus (USB) connectors, and you'll see lots of USB accessories six months from now. If you're buying for the office, get a 10/100-Mbps network card, even if you have only a 10-Mbps LAN now. DMI (desktop management interface) compliance is a must; look also at vendors offering predictive failure warnings on key components such as

hard disks. All that drives down the total cost of ownership, which dwarfs purchase cost. And in case you're buying a home PC, from now through March vendors will be shifting to the 1997 editions of their free software.

The key to success is buying enough power today so that you won't have to open up the case of your PC for at least two years, and maybe never. For a well-equipped system with a Pentium MMX/200, 32MB SDRAM, 256K pipeline-burst cache, a 10X or 12X CD-ROM drive, a 4MB graphics adapter, a 17-inch monitor, a 33.6-Kbps modem, and a wavetable audio sound card with decent speakers, you should expect to spend \$2,500 to \$3,000. □

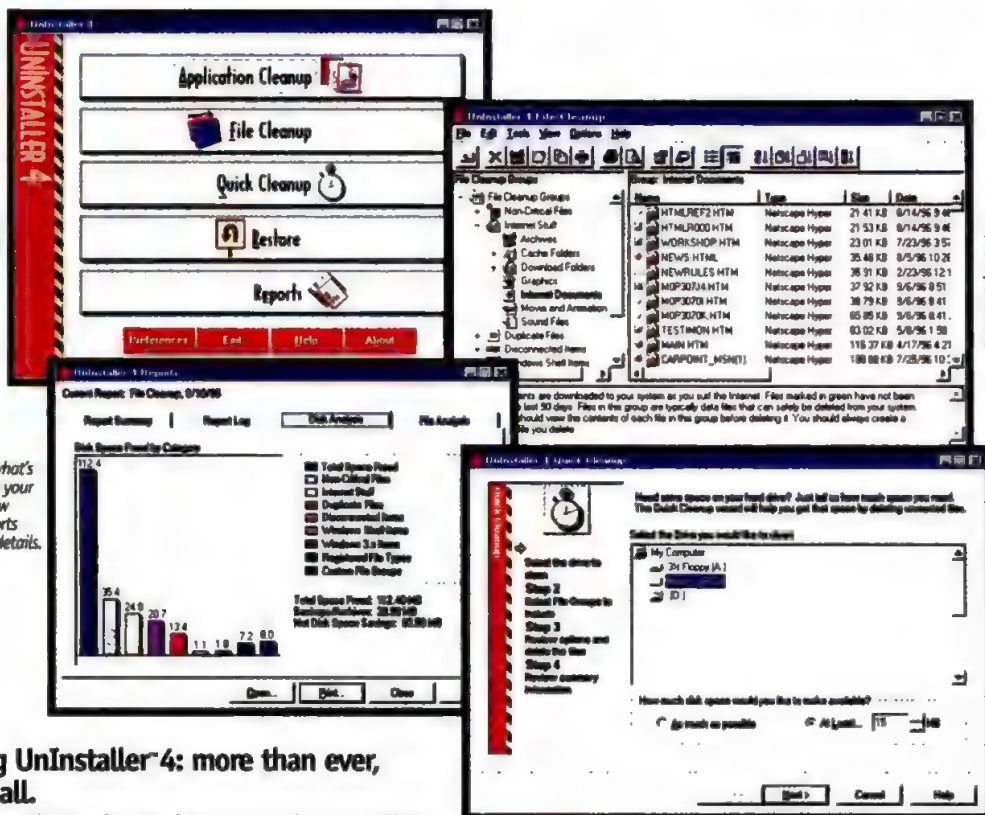


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ISDN ROUTERS

Fast Routes to the Net

ISDN routers offer fast, multiuser connections for telecommuting and Internet access.



By Les Freed

The ever-increasing demand for faster and more reliable Internet access is driving a surge in demand for ISDN service. In the process, ISDN may finally have overcome its catch-22 situation of a few years ago.

Since telephone-company personnel weren't familiar with the technology, ISDN service was often difficult to obtain, and it frequently didn't work correctly once it was installed. Early ISDN equipment had to be hand-tweaked to operate with a particular set of ISDN line options, and some products took hours—or days—of fiddling to make them work. Thanks to increased demand, the phone companies and equipment vendors have made tremendous progress.

ILLUSTRATION BY SAM WARD

INSIDE



The Internet explosion has presented corporate networks with a variety of new connectivity and management challenges. In this issue of the Network

Edition, we attack the Internet from both ends.

ISDN ROUTERS MAKE INEXPENSIVE

solutions for connecting home offices, small businesses, or branch offices to the Net or to corporate central sites. In "Fast Routes to the Net," our Network Edition cover story, contributing editor Les Freed tests eight small-office ISDN routers. Les set up the products and tested their performance when connected over ISDN to an Ascend MAX 4000 central-site router—a popular central-site device among Internet service providers. He also checked out interoperability with the Cisco 4500.

THE GOOD NEWS IS that we had much better success making these products work together than in the past. But getting them to negotiate compression was another story.

INTERNET FIREWALLS are at the heart of our First Looks section in this issue. Until recently firewalls were all Unix-based—making them an adventure for the Unix neophyte.

THE NEW RAGE IS FIREWALLS based on Microsoft Windows NT Server. There have been several new product introductions in the past six months, and project leader Jeffrey Witt installed and tested four of them for First Looks to see how they would measure up. (Page NE19.)

TOTAL COST OF OWNERSHIP (TCO) is the subject tackled by West Coast PC Labs director Steve Buehler in this issue. He tells you how to get a firm handle on it in Multiple Access. (Page NE22.)

—By Leon Erlanger

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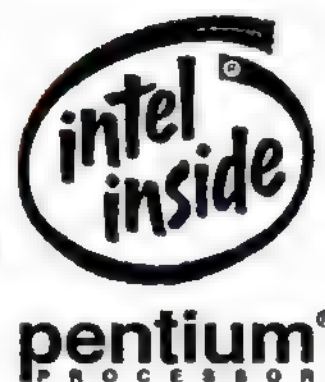
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TA VS. ROUTER

Given the excellent choices and low prices of the ISDN terminal adapters now on the market (see "Digital Dragsters" in this issue for reviews of ISDN adapters), why would anyone buy a router for home or small-business use? There are several good reasons. First, routers dial and disconnect automatically based on whether data has to move across the ISDN line. If you've ever walked away from your PC and unintentionally left your TA connected to your ISP for eight hours, you'll know why this is important. Second, since routers communicate with PCs via Ethernet, they aren't constrained by the 115.2-Kbps limitation of the PC's serial port, as are all external and many internal ISDN adapters. True, you'll need an Ethernet card in your PC to connect to the router, but a decent 10Base-T card can be had for less than \$75. Third, multiple-PC home and small-office LANs are becoming more common. You can't share an ISDN TA among several PCs, but one router can serve all the PCs on your LAN.

For this feature we tested eight small-office ISDN routers. We required that each have at least one ISDN BRI port and compatibility with the Multilink PPP (MP) standard, and that they have at least one analog POTS (plain old telephone service) port for connecting an analog phone or fax machine. (See the glossary in "Digital Dragsters" in this issue for definitions of these terms.) We also required that they be able to connect with an Ascend MAX 4000 router, which was our central-site test device and is very widely used by Internet service providers (ISPs). We received products from Advanced Computer Communications, Ascend Communications, Bay Networks, Cisco Systems, Gandalf Technologies, Osicom Technologies, Shiva Corporation, and ZyXEL Communications.

All the products in our roundup provide IP routing over a single ISDN line. All except Gandalf Technologies' XpressConnect 5242i Edge Router provide IPX routing as well. Some products also offer bridging, and a few provide AppleTalk routing support. Two products—Osicom's NetHopper, and ZyXEL's Prestige 2864I—provide support for V.34 modem connections. Osicom actually provides a modem, and ZyXEL has a modem emulator. The latter is a valuable feature that lets users call into the network from the road using a modem.

These products are all designed to connect a small branch office, small business office, or home office to an Internet service provider or to a corporate LAN. ACC's Congo and Shiva's AccessPort are de-

Editors' Choice

• Ascend Pipeline 75



All of the ISDN routers installed without major

problems and performed well on our tests. A few products, however, have features that make life easier for the average small- or home-office user. Ascend's Pipeline 75 receives our Editors' Choice for its easy installation and trouble-free operation. It comes with two POTS ports for analog phones and fax machines, and it's one of only two

signed clearly with the home and small-business buyer in mind. Both have excellent configuration software—Shiva's is Windows-based and ACC's is browser-based. They also have support for two POTS telephone devices and good diagnostic and status reporting tools.

Other products, such as Ascend's Pipeline 75 and Cisco's 766 model, are designed to appeal to the corporate buyer. Although they lack the flashy retail packaging of the ACC, Shiva, and ZyXEL products, they are equally suited to home and small-office use. Both provide excellent POTS telephone support, letting you replace all your POTS service with ISDN.

WHAT WE FOUND

When we last looked at ISDN routers ("LAN on Demand," April 9, 1996) we had serious problems making MP connections between different vendors' equipment. The good news is that all of our test products were able to make an MP connection to our MAX 4000 test router. At first, however, three of the products couldn't log onto our test server at all because we had configured the MAX 4000 to identify incoming callers based on caller ID data. Caller ID provides excellent security, and many organizations and ISPs use it, instead of PAP or CHAP user authentication.

Bay Networks' CLAM, Osicom's NetHopper, and ZyXEL's Prestige 2864I all had problems making an MP connection to the MAX 4000 using caller ID authentication. But the vendors provided us with firmware updates that corrected the problem.

products we tested that successfully negotiated Hifi compression with our MAX 4000 test router—a very popular central-site device among Internet service providers. As we went to press, Ascend announced a Java-based configuration utility that is downloadable from its Web site.

Honorable mentions go to the ZyXEL's Prestige 2864I for its Ascend-compatible compression, V.34 modem emulation, and ability to connect to an ISP using a single, dynamically assigned IP address, and the Shiva AccessPort, whose installation and monitoring software was unquestionably the best. If not for a problem with bandwidth on demand, which Shiva expects to solve with a firmware update, the AccessPort would have been our Editors' Choice.

Unfortunately, however, we found another monkey wrench in the works: data compression. Almost all of the products in our test group can perform Hifi (formerly known as Stac LZS) data compression, but only two products—Ascend's Pipeline 75 and the XpressConnect 5242i Edge Router—could perform data compression successfully with our MAX 4000 test router.

To illustrate the importance of compression, we tested both products with compression turned on. Using a mix of compressible and uncompressible text files, the Pipeline 75, for example, averaged a compression ratio of 2.5:1 on a single B-channel, and 1.95:1 on two B-channels.

Pacific Bell recently held an ISDN interoperability workshop that was attended by all the major ISDN equipment vendors and service providers. Reports from the workshop indicate that the equipment vendors, Internet service providers, and phone companies are working together to resolve the outstanding compression problems.

Once we had our compatibility hurdles behind us, we set out to measure the performance of our test products. Because of the problem with compression negotiation, we conducted our tests with compression turned off in all the products. All eight products performed nearly identically, with only a few percentage points between them.

If they all performed pretty much the same, what's the major difference in these products? Apart from obvious factors such as POTS and modem support, the greatest variation was in our out-of-box

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experience. The eight products we tested varied widely in their ease of use. Top honors go to Shiva, Cisco, and ACC for their innovative, Windows- and browser-based setup programs; Shiva's is far and away the best of the lot. We encountered some minor installation hassles with ACC's product. Although the Pipeline 75 doesn't come with a PC-based setup program, its built-in hierarchical menu system is a model of usability and efficiency. ZyXEL's menu system is easy to understand and operate, but it handles like a late 1970s CP/M program interface.

The ZyXEL Prestige offers dynamic IP addressing, which lets you connect several users to an ISP using a single-user account instead of a more expensive router account.

This is a relatively new product category. The interoperability standards are still being refined, and frequent software updates are likely. All eight products in our test group store their firmware in non-volatile memory; some use flash ROMs, and one uses a floppy disk.

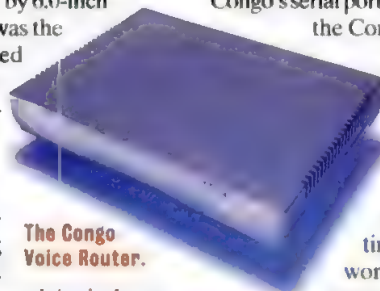
Advanced Computer Communications Inc.

Congo Voice Router

ALL REVIEWS BY LES FREED

Aimed squarely at the SOHO market, Advanced Computer Communications' Congo Voice Router (\$1,395 for a U interface; \$1,295 for an S/T interface) packs IPX and IP routing, a built-in NT-1, two POTS ports, and eight status LEDs into an attractive 1.5- by 8.5- by 6.0-inch (HWD) package. This was the only product we tested with a rear-panel switch that can be used to disable data functions but leave the POTS ports alive. It can provide excellent after-hours security while still allowing incoming faxes and phone calls. Our only complaint is that we found installation and configuration a little more complicated than with most of the other routers we tested.

There are two ways to configure the



The Congo Voice Router.

Congo. The Congo Web Wizard installer program creates an HTTP server on your PC. You point your browser to your PC's own IP address, fill in an HTML form and you're on your way. But the Web Wizard can only perform the initial configuration. To make subsequent changes, you have to connect a terminal to the Congo and enter commands manually.

You can also connect a PC directly to the Congo's serial port for the initial installation;

the Congo walks you through a straightforward configuration questionnaire.

The Congo's canned configuration scripts appeared to work fine, but we had to adjust some configuration settings manually to make it work with our MAX 4000 test router. Unlike most of the other routers, the Congo has a configuration script that assumes you want to place data calls at 56 Kbps, so we had to reconfigure it to place calls at 64 Kbps. Also,

PERFORMANCE TESTS

ISDN Routers



The eight products in our test group ran a very close race. The Shiva AccessPort was marginally faster than the other products on our single B-channel (64-Kbps) test, and Ascend's Pipeline

75 was slightly faster than the others when running on two B-channels. Virtually all of the routers ran nearly twice as fast on two B-channels than they did on one, except for ZyXEL's Prestige 2864I.

Three products—Bay Networks' CLAM, Osicom's NetHopper, and ZyXEL's Prestige 2864I—couldn't negotiate a Multilink PPP connection when the Pipeline 75 was configured for caller ID authentication. The three vendors, however, provided us with firmware updates that corrected this problem.

Except for the Pipeline 75 and Gandalf's XpressConnect 5242i Edge Router, none of the products in our test group could negotiate data compression with our MAX 4000. This is because of inconsistencies in each vendor's implementation of the Compression Control Protocol. All seven vendors are working to resolve the problem in the near future.

The eight products all passed our compatibility tests when dialing into both the MAX 4000 and the Cisco 4500.

We set up a small 10-Mbps Ethernet LAN containing four 200-MHz Pentium PCs running Windows 95, a Power

Macintosh 8500/132 running System 7.5.3, and a Pentium 200 server running Windows NT Server 4.0. We connected each test router to the LAN and configured the router to dial over ISDN into the other side of our test setup—a MAX 4000 test router connected to a Sun SparcStation.

We ran a series of file transfers using the Solaris FTP client on the host side and the WS_FTP32 file transfer program on our test LAN. We transferred four files: a 983K graphics file, a 327K executable file, a 131K compressed JPEG image file, and a file containing 128K of random data. The times reported here are averages for the four file types. We ran each test three times to confirm the results.

THROUGHPUT		
	One B-channel Kbps	Two B-channels Kbps
WITHOUT COMPRESSION		
ACC Congo Voice Router	54	96
Ascend Pipeline 75	52	105
Bay Networks CLAM	53	100
Cisco 766	54	101
Gandalf XpressConnect 5242i	52	98
Osicom NetHopper NH-BRI 616	54	103
Shiva AccessPort	55	102
ZyXEL Prestige 2864I	54	96
WITH COMPRESSION		
Ascend Pipeline 75	133	204
Gandalf XpressConnect 5242i	135	191

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SUMMARY OF FEATURES

Remote-Site ISDN Routers

PC MAGAZINE
NETWORK EDITION
EDITORS' CHOICE

	Advanced Computer Communications Inc. Congo Voice Router	Ascend Communications Inc. Pipeline 75	Bay Networks Inc. CLAM	Cisco Systems Inc. Cisco 766	Gandalf Technologies Inc. XpressConnect 5242i Edge Router	Osicom Technologies Inc. NetHopper NH-BRI 616	Shiva Corp. Shiva AccessPort	ZyXEL Communications Inc. Prestige2064i
■ YES ■ NO								
In alphabetical order by company.								
List price of tested configuration	\$1,395	\$995	\$1,195	\$1,099	\$1,195	\$1,695	\$995	\$1,099
Hardware Features								
Number of BRI lines	1	1	1	1	1	1	1	1
Number of analog ports	2	2	1 (\$200 option)	2	1	1	2	1
28.8-Kbps modem included	■	■	■	■	■	■	■	■*
Bandwidth on demand	■	■	■	■	■	■	■	■
Number of status LEDs	10	5	1	14	5	12	8	12
Software Features								
Bridged protocols	TCP/IP, IPX, AppleTalk	TCP/IP, IPX, AppleTalk, Net- BEUI, NetBIOS	TCP/IP, IPX	IP, IPX, AppleTalk, NetBIOS	TCP/IP, IPX	None	TCP/IP, IPX, AppleTalk, Net- BEUI, NetBIOS	TCP/IP, IPX
Routed protocols	IP, IPX	TCP/IP, IPX	IP, IPX	IP, IPX	IP	IP, IPX	IP, IPX	IP, IPX
IPX/SPX spoofing	■	■	■	■	■	■	■	■
Supports data over voice	■	■	■	■	■	■	■	■
Works with single dynamic IP account	■	■	■	■	■	■	■	■
Management								
Dial on demand	■	■	■	■	■	■	■	■
Programmable time/usage limits	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■**
Security								
Calling line identification/ authentication	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
User callback	■	■	■	■	■	■	■	■

* This product contains a modem emulator. ** The administrator can limit the amount of access time but not specify particular hours.

despite technical assistance from an ACC technician, we were unable to configure the Congo's bandwidth-on-demand feature. So we had to let the product decide for itself when to add and drop the second B-channel.

Congo Voice Router. List price: Tested configuration, \$1,395. Advanced Computer Communications Inc., Santa Barbara, CA; 800-444-7854, 805-685-4455; fax, 805-685-4465; www.acc.com. **Circle 951 on reader service card.**

Ascend Communications Inc.

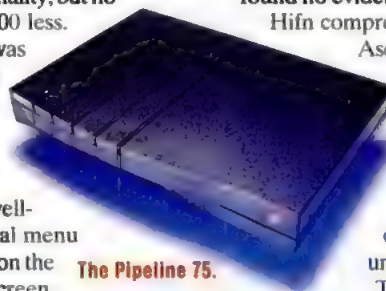
Pipeline 75



The newest model in Ascend Communications' popular Pipeline product line, the \$995 Pipeline 75 provides IP and IPX routing and bridging, two POTS ports, and Multilink PPP with bandwidth on demand. Not surprisingly, the Pipeline 75 is one of the only two products in our test group that successfully negotiated Hfrn (formerly known as STAC LZS) data compression with our Ascend MAX 4000 test router. If you intend to connect to

an ISP or central office that has an Ascend router with compression enabled, you should definitely keep this in mind, as it could mean a significant performance boost. If you don't need the POTS ports, the Pipeline 50 model provides identical ISDN router functionality, but no POTS ports, for \$100 less.

The Pipeline 75 was one of the easiest products to configure. We connected a PC to the Pipeline 75's serial interface port. A well-designed hierarchical menu shows system status on the right side of the screen, and it allowed us to enter configuration options on the left side. A Configuration choice on the main menu prompted us for essential information, such as phone numbers, IP addresses, and service provider identifiers (SPIDs), but it did not offer any online help. Using the Pipeline 75's comprehensive, well-organized manual, we got the Pipeline working in about 10 minutes. As we went to press, Ascend announced its new Java-



The Pipeline 75.

based Pipeline Configurator, which can be downloaded from the company's Web site.

The Pipeline 75 supports Ascend's own Multilink Plus. Ascend claims that Multilink Plus has some extra features that improve performance over regular MP, but we found no evidence of this in our tests. The Hfrn compression used on Ascend-to-

Ascend links worked very well, providing 3.5:1 compression on a plain text file and 2:1 on an uncompressed JPEG graphic file. The Pipeline's compression software got out of the way when we fed it an uncompressible test file.

The Pipeline 75 inherited many features from Ascend's larger routers, including SNMP management, support for frame relay over ISDN, caller ID, and support for third-party authentication servers.

Pipeline 75. List price: Tested configuration, \$995. Ascend Communications Inc., Alameda, CA; 800-272-3634, 510-769-6001; fax, 510-747-2300; www.ascend.com. **Circle 952 on reader service card.**

Bay Networks Inc.

CLAM

Bay Networks' CLAM (Corporate LAN Access Module) router (\$1,195) packs some interesting features into a tiny, 1.5- by 5.4- by 5.1-inch (HWD), clam-shaped package. Originally designed for the European market, the CLAM router came across the ocean when Bay Networks purchased U.K.-based Xylogics early last year.

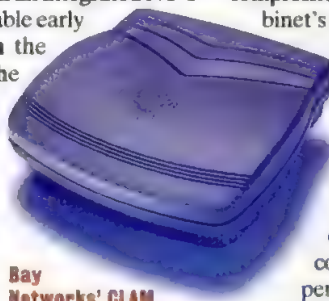
The CLAM's European heritage shows in its lack of a built-in NT-1 interface. Bay Networks is providing a free, external NT-1 with the CLAM until an integrated NT-1 model becomes available early this year. Even with the integrated NT-1, the router box should stay the same size it is today, according to Bay Networks. Almost as large as the CLAM, the present NT-1 adds considerable cable clutter. The unit provided for our roundup had no RJ-11 POTS ports, but one is available as a \$200 option.

The CLAM is one of three products that couldn't connect with our test router at first use of caller ID. Bay Networks sent us a firmware update that solved the problem.

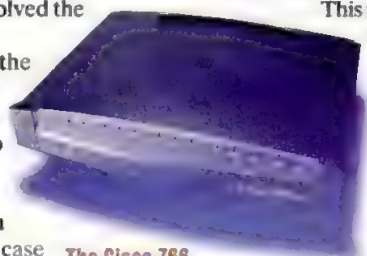
Like the Cisco 766, the CLAM can operate as an Ethernet hub, so you can connect it to a single PC. To connect the CLAM to an Ethernet hub, you must open the CLAM case and move four jumpers.

To configure the CLAM, you connect a PC to the product's serial port and use its menu-driven user interface. The first time you connect a terminal, the CLAM walks you through the configuration process. Once you've configured the CLAM's IP address, you can configure or monitor it from any PC on your IP LAN.

The CLAM has only one status LED, which we found just marginally useful. The CLAM supports data compression when connected to another Bay Networks router, but the compression was not compatible with our MAX 4000 test router. A Bay Networks representative informed us that an upcoming firmware release will add Ascend-compatible Hifi compression.



Bay Networks' CLAM.



The Cisco 766.

CLAM. List price: Tested configuration, \$1,195. Bay Networks Inc., Burlington, MA; 800-225-3317, 508-670-8888; www.baynetworks.com. Circle 953 on reader service card.

Cisco Systems Inc.

Cisco 766

Cisco Systems is well known for its large backbone and remote-access routers. Last year, Cisco acquired Combinet, a maker of smaller ISDN routers for the SOHO market. The Cisco 766 (\$799 for 4 users, \$1,099 for 1,500 users with STAC compression) is an updated version of Combinet's popular 2000 series router with exceptionally easy installation and some excellent features. As with Ascend Communications, the Cisco's routers are popular among ISPs. If you are connecting to an ISP or central office that uses a Cisco router with compression enabled, the Cisco's compression will give you superior performance.

The Cisco improves on the earlier Combinet's configuration software and adds two analog ports and a more attractive case, while maintaining the rock-solid reliability that comes from a mature product.

This was the only unit we tested with an S/T jack, which can be used to connect an ISDN telephone or a Group IV ISDN fax machine. The front panel sports 14 green status LEDs which provide detailed operational status at a glance.

Like Bay Networks' CLAM, the Cisco can operate as an Ethernet hub, so you can connect it to a single PC with no external hub. If you want to connect the Cisco to a hub, you just flick a switch on the back of the unit. The analog ports provide a ringer equivalence of 5.0, which means that the Cisco can operate several telephones or other devices on each port.

We configured the product in approximately 10 minutes using Cisco Click-Start, a browser-based installation and configuration program. Experienced Combinet users may opt to use the command-line in-

terface instead, which is essentially unchanged from earlier versions.

The Cisco's documentation is exemplary. Two-inch-thick manuals provide detailed information on routing and bridging, including dozens of step-by-step instructions on configuring the router for specific applications.

Cisco 766. List price: Tested configuration, \$1,099. Cisco Systems Inc., San Jose, CA; 800-553-6387, 408-526-4000; fax, 408-526-4100; www.cisco.com. Circle 954 on reader service card.

Gandalf Technologies Inc.

XpressConnect 5242i Edge Router

An Editors' Choice in our last ISDN router roundup, the XpressConnect 5242i Edge Router (\$1,195), from Gandalf Technologies, still holds its own against the newest crop of competitors with easy installation and Ascend-compatible compression support. The XpressConnect has one POTS port; a no-POTS version is available for \$250 less.

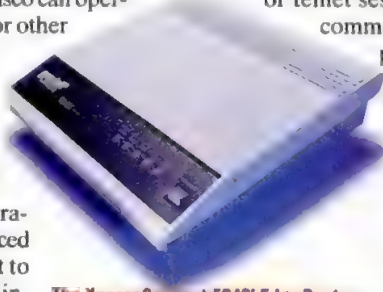
The XpressConnect is available with either of two firmware packages. With the Teleworker bridge software installed, the XpressConnect can connect only to Gandalf's host routers. Our test unit came with the Edge Router firmware, which provides IP routing over standard PPP and MP links.

The XpressConnect has Hifi-compatible data compression, and it is one of only two products in our test group to have successfully used data compression when connected to our MAX 4000 test router. If you connect to an ISP that uses an Ascend router with compression enabled, this capability provides you with superior performance.

The new XpressView software draws a picture of the router on your screen; you point and click on the picture to set the configuration options. The software makes configuration a simple, fill-in-the-blanks task. You can also configure the XpressConnect via an RS232 terminal or telnet session using the router's command-line interface, or

perform basic configuration tasks by pressing buttons on a touch-tone phone attached to the POTS port.

There are five LEDs on the XpressConnect's front panel that show power, LAN, phone line, and ISDN status.



The XpressConnect 5242i Edge Router.

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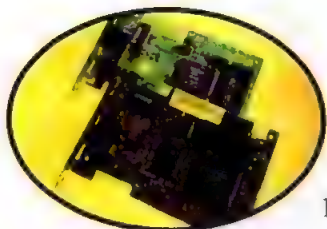
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XpressConnect 5242i Edge Router. List price: Tested configuration, \$1,195. Gandalf Technologies Inc., Nepean, Ontario, Canada; 800-426-3253, 613-274-6500; fax, 613-274-6501; www.gandalf.ca. *Circle 955 on reader service card.*

Osicom Technologies Inc.

NetHopper NH-BRI 616

With the NASA-like appearance of its molded plastic case and front, and its mounted 3.5-inch floppy disk drive, Osicom Technologies' NetHopper NH-BRI 616 ISDN router (\$1,695) immediately struck us as different from the other products in our roundup. On the back, there are the usual ISDN and LAN connectors, and an analog port. But unlike the other products, the RNS NetHopper comes with its own V.34 modem, so the analog port attaches to a phone line, not to a phone.

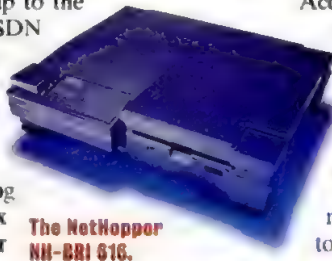
The built-in modem is very useful for dialing into the network from the road or as a backup to the router's ISDN functionality, but the NetHopper does not provide a way to use your analog phones or fax machines over the ISDN line.

And while the NetHopper routes IP and IPX, it is unlike the other products in not bridging any protocols or supporting bandwidth on demand.

The NetHopper actually boots from a floppy disk. There are pros and cons to this approach. On the plus side, software updates are easy to install, and it's simple to make backup copies of your current configuration. On the downside, it takes 2 or 3 minutes to start up the NetHopper.

We were able to configure the NetHopper using the built-in configuration questionnaire. The NetHopper was one of three products that wouldn't connect with our test router at first because it didn't support caller ID authentication. A firmware update from Osicom cleared up the problem.

NetHopper NH-BRI 616. List price: Tested configuration, \$1,695. Osicom Technologies Inc., Santa Barbara, CA; 800-262-8023, 805-968-4262; fax, 805-968-6478; www.rns.com. *Circle 956 on reader service card.*



The NetHopper NH-BRI 616.

Shiva Corp.

Shiva AccessPort

Like the Congo Voice Router, the Shiva AccessPort (\$995), from Shiva Corp., hits all the hot buttons for the SOHO market. In addition to IP and IPX routing and IP bridging, Multilink PPP, and STAC compression, the AccessPort comes with two analog ports and the best installation software we've seen.

In our testing, however, we discovered a problem with the AccessPort's bandwidth-on-demand feature. When connected to an Ascend host router, the AccessPort brings up the second B-channel only if the volume of outgoing—not incoming—traffic warrants it. This means that if you are downloading a large file from an FTP site using an Ascend router, the AccessPort continues to run on one B-channel

only. For our throughput testing, we manually configured the AccessPort to always use two B-channels. We did confirm that the AccessPort's bandwidth-on-demand functions work correctly in both directions when connected to a Cisco or Shiva host router.

A Shiva representative confirmed that the company is aware of the bandwidth problem and is working on a firmware update.

Shiva's installation and monitoring software is far and away the best we've found. A Windows-based Wizard guides you through the initial installation process, providing helpful information at each step. Once you've performed the initial installation, the Shiva Monitor program shows a detailed graphical view of the front and rear of the AccessPort, complete with working on-screen LEDs.

The Monitor provides excellent monitoring and statistical information, including how long the AccessPort has been connected and the current bandwidth. It also allows you to check and change configuration settings. You can use the Shiva Monitor to control and configure several AccessPort units remotely on your LAN.

Shiva AccessPort. List price: Tested config-



The Shiva AccessPort.

uration, \$995. Shiva Corp., Bedford, MA; 800-847-4482, 617-270-8300; fax, 617-270-8599; www.shiva.com. *Circle 957 on reader service card.*

ZyXEL Communications Inc.

Prestige 2864I

ZyXEL Communications is a newcomer to the ISDN marketplace, but you'd never know it from its Prestige 2864I router. The \$1,099 Prestige is one of only two products that can accept a V.34 modem connection. It does this by using a V.34 modem emulator. The Prestige also comes with its own firewall and supports dynamic IP addressing, letting you connect several users to an ISP with a single-user account instead of with a more expensive router account.

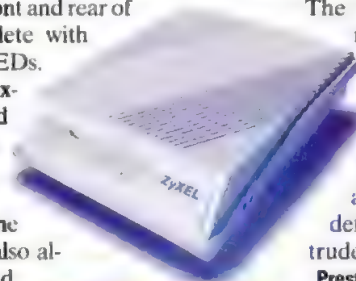
You can use the modem emulator over the ISDN line as a backup for greater flexibility to connect to an ISP or another router, or dial into the modem to connect to the office network from the road. The Prestige also comes with one POTS port, which can be assigned to either of two ISDN phone numbers.

The Prestige was one of three products that wouldn't connect with our Ascend test router at first because it didn't support caller ID authentication. After we obtained a firmware update from the manufacturer, we had the Prestige up and working in about 10 minutes. As with most of the other products, the initial configuration is performed from a PC attached to the Prestige's serial port, with subsequent changes made via telnet. Its built-in configuration menu is straightforward and easy to understand, if a little old-fashioned looking.

The Prestige can operate as a normal IP and IPX router.

An AppleTalk routing option is available for mixed PC/Mac networks. The product's IP firewall is easy to configure and provides a first line of defense against unwanted intruders. □

Prestige 2864I. List price: Tested configuration, \$1,099. ZyXEL Communications Inc., Anaheim, CA; 800-255-4101, 714-693-0808; fax, 714-693-8811; www.zyxel.com. *Circle 958 on reader service card.*



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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

WINDOWS NT FIREWALLS

Windows NT Firewalls Are Born

By Jeffrey G. Witt

To many, the roar of the Internet sounds like a hymn to capitalism, whose lyrics enumerate new ways of doing business and communicating. But with these new ways come a host of security issues, and a concomitant need for firewalls.

Just as the Internet is firmly rooted in Unix, so Unix has also been the platform of choice for firewalls. But with Microsoft Windows NT becoming more prevalent, the need for Windows NT firewalls has emerged, paralleling previous developments in the Web server market. Many companies—including CheckPoint, Global Internet, NetGuard, and Raptor, whose products we review here—have recently unveiled the first round of Windows NT firewalls.

Some argue that Windows NT may not be as secure as Unix because it doesn't allow the same fine-tuning that Unix does. And if you have a problem with Windows NT, you must wait for Microsoft to fix it; with Unix you can fix it yourself. We didn't find any obvious security glitches in the Windows NT firewalls, but we didn't test them against Unix products. We did find that deploying a Windows NT firewall is no easy task. Firewalls still require extensive pretesting and tailoring.

Ultimately, your choice of a firewall platform should depend on your network and what you're comfortable with. Firewalls on any platform—including Windows NT—do not offer instant security utopia. They provide one solution in a com-

plex, ever-changing world of security challenges. For more information on firewalls, see PC Magazine Online.

Global Internet Inc.

Centri Firewall

An application-level method based on technology licensed from the Unix firewall veteran, Trusted Information Systems, is at the core of newcomer Global Internet's Centri Firewall 3.1. In addition, Global Internet has leveraged its relationship with Microsoft to add IP-level hardening and packet filtering to the existing Windows NT TCP/IP stack. But Centri Firewall doesn't offer

the more extensive management capabilities of the other firewalls in our roundup, remote security, or virtual private network (VPN) capabilities.

Our installation went without incident, and Centri Firewall's graphical management interface takes one of the clearest and most concise approaches of all the products we tested. It presented simple tabbed menus for FTP, HTTP, SMTP, telnet, and News proxies. Customized or additional services are added via the Plug proxy. An easy-to-define packet-filtering module and a network address translation (NAT) module, which protects against spoofing, are available from the same main menu.

User authentication is established on a standard password basis or by using S/Key or SNK standards.

Centri Firewall lets you define FTP traffic gets and puts on a per-user basis. And HTTP functions, such as dir, writes, and reads, can be enabled and disabled by using check-off boxes.

Unlike Eagle NT, Firewall-1, and Guardian—which can control multiple firewalls centrally—Centri Firewall must be administered at the Windows NT server. And Centri Firewall does not have real-time session monitoring or alerting options. Sweeper reports, which are constant audits, are compiled daily, however, and you can have activity logs mailed to you.

IS shops looking for a suite of products to fill out their Internet connectivity needs will be happy to find MetaInfo's DNS and

SUMMARY OF FEATURES

WINDOWSNT FIREWALLS

■ YES ■ NO ■ OPTIONAL

Products listed in alphabetical order

	Centri Firewall 3.1	CheckPoint Firewall-1 for Windows NT 2.1b	Eagle NT 3.06	Guardian 2.0
List price for 50 users	\$5,000	\$4,495	\$5,995	\$3,980
Recommended hardware: CPU/RAM/hard disk	Pentium/90, 32MB, 2GB	Pentium/133, 32MB, 1GB	Pentium, 32MB, 1GB	Pentium/120, 32MB, 160MB
Uses Windows NT domain users and attributes	■	■	■	■
Firewall architecture	Application gateway	Stateful inspection	Application-level proxy	MAC-layer packet filter
Provides Virtual Private Network (VPN)	■	■	■	■
Works with DHCP/WINS	■	■	■	■
Client Encryption for Remote Access	■	■	■	■
IP address translation	■	■	■	■
URL access control	■	■	■	■
Can block Java/ActiveX	■	■	■	■
Update and customization of services	■	■	■	■
Detects IP spoofing	■	■	■	■
Alerts via e-mail/pager/SNMP	■	■	■	■
Administrator can manage across network	■	■	■	■
Console manages multiple firewalls	■	■	■	■
Administrator can view real-time sessions/logs	■	■	■	■
Supports SSL	■	■	■	■
Restrict via time/application/bandwidth	■	■	■	■

SMTP Sendmail bundled with Centri Firewall. And though Centri Firewall doesn't have the level of bandwidth control that NetGuard's Guardian does, a caching option is included for speedier access to frequently used Web sites. You can use the built-in filters to control user access to specific URLs.

Centri Firewall, along with FireWall-1, offers Java blocking. By the time you read this, it should also block Microsoft's ActiveX. —JGW

Centri Firewall 3.1. List price: For 50 users, \$5,000. Global Internet Inc., Palo Alto, CA; 800-682-5550; www.globalinternet.com. Circle 960 on reader service card.

CheckPoint Software Technologies Inc.

CheckPoint FireWall-1 for Windows NT

With CheckPoint FireWall-1 for Windows NT 3.51, Version 2.1, CheckPoint Software Technologies has made the move to the Windows NT market. Its initial offering in this area is easy to install, use, and manage—for a firewall. FireWall-1 runs as a service on Windows NT 3.51 and should be available for Windows NT 4.0 by the time you read this. You need to have Service Pack 4 for Windows NT 3.51 installed and SNMP enabled.

The patented technology underlying FireWall-1 is called Stateful Multilayer Inspection. CheckPoint recently licensed this to Bay Networks, U.S. Robotics, and Xylan, who plan to build FireWall-1 capabilities into routers and remote-access servers.

Stateful Multilayer Inspection is a cross between packet filtering and application gateways. The technology takes advantage of packet filtering's superior performance and scalability while applying the security of an application gateway. Its Inspection Engine

applies full application-level security but never lets packets reach the operating system of the machine the firewall sits on.

FireWall-1 is the only product in our roundup that gives you the ability to set up VPNs and the only one to provide a Windows 95 remote client. Secure Remote allows a user to establish a VPN connection with the corporate firewall while away from the office, which allows the remote user to access any TCP/IP application on the corporate network.

FireWall-1 consists of two modules. The management module lets you manage multiple firewalls from a central location.

The gateway portion of FireWall-1, which manages security policy, resides on a Windows NT machine and has an easy-to-use administration GUI. We installed the software license key and quickly defined the firewall's administrators and remote-management clients. Using the management module, we then created the security policy to place on the firewall.

In addition to its unique technology, FireWall-1's management module consists of the Security Policy, Log Viewer, and System Status. Security Policy lets you create rules that govern your network's security. The Log Viewer keeps track of and manages all gateway activity and provides tools for sorting the data, creating detailed reports, and alerting administrators via e-mail or pager to any suspicious activity. —Andrew Go

CheckPoint FireWall-1 for Windows NT 3.51, Version 2.1. List price: For 50 users, \$4,495. CheckPoint Software Technologies Inc., Redwood City, CA; 800-429-4391, 415-562-0400; www.checkpoint.com. Circle 962 on reader service card.



Frank Derfler

“As the politicians say, Leon, I'm staying “on message.” It's IP, stupid! The thought of putting IP on a LAN that also has a link to the Internet scares me silly. The statistics on the number of silent intrusions speak volumes. But if you've got to have IP, you've got to have a firewall. These products change the problem from a technical threat to an administrative challenge.”

“Exactly, Frank. Important parts of that administrative challenge are configuring the firewalls correctly and keeping up-to-date about the latest tricks and threats. Readers should be aware that they'll maintain a close relationship with their firewall vendor. You need a long-term support contract, so choose your vendor carefully.”



Leon Erlanger

Raptor Systems Inc.

Eagle NT

Raptor Systems, first to ship a Microsoft Windows NT-based product, offers a powerful application-level architecture in its new Eagle NT 3.06. The product includes proxies for such common TCP/IP applications as FTP, Gopher, HTTP, SMTP, and WAIS. Eagle NT also lets you easily define new and other applications and translates the user's IP address to the firewall address. Currently, VPN options are present but not usable in Eagle NT. They should be implemented in future releases.

Eagle NT is unique among the products in our roundup in its ability to read users and their attributes from Windows NT's domain services. This eliminates the redundant creation of client accounts, passwords, and identification. Eagle

NT uses Windows NT's native Event Viewer and Performance Monitor.

Installation was straightforward, and we were impressed by the extensive list of supported network adapters, including Token-Ring. Eagle NT runs as a Windows NT service, and it installed virtual LAN drivers for both of our adapters.

Eagle NT is managed via a GUI interface that is more reminiscent of a Unix than a Windows NT interface. Many of the windows are difficult to size, scroll, or manipulate.

Rules are set up through a single Authorization window. Eagle NT's pulldown menus and buttons are easy to navigate, but the novice firewall administrator may want the advice available in such setup wizards as the ones included with NetGuard's Guardian. Eagle NT also lacks online help, though the printed documentation is excellent.

Eagle NT handled security setup for our Web and FTP servers with aplomb, and we were able to monitor connections through Eagle NT's Gateway window, which lets you terminate sessions.

Compared with the other firewalls in our roundup, Eagle NT offered the most extensive notification options. Alerts can be sent by e-mail, SNMP, fax, pager, and audio. Thresholds can be specified based on anticipated access by the minute, hour, day, and week. The real-time suspicious-activity monitor observes these thresholds and logs an alert when they are met or exceeded.

The management console, Hawk, can be loaded separately on a remote station, so you can manage multiple firewalls. But you can't monitor Raptor's Unix



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First Looks

firewalls with Hawk as you can with CheckPoint's FireWall-1. And Eagle NT doesn't have encryption. —JGW

Eagle NT 3.06. List price: For 50 users, \$6,500. Raptor Systems Inc., Waltham, MA; 800-932-4536; www.raptor.com. Circle 961 on reader service card.

NetGuard Inc. Guardian 2.0

The Windows NT firewall offering from NetGuard, Guardian 2.0, which uses packet-filtering, gives you the ability to monitor in real time not only security vulnerabilities but valuable bandwidth resources. Guardian acts as a traffic cop, enforcing optimal use of the connection between secure and unsecured networks. One thing Guardian doesn't yet have is VPN

functionality, but it should be included by the time you read this.

Guardian consists of two pieces: the Agent, which is the actual firewall, and the Manager, which is set up on any network client or on the Windows NT server itself. The Manager, like the consoles included with Raptor's Eagle NT and CheckPoint's FireWall-1,

lets you manage multiple firewalls centrally. For additional security, the Agent-to-Manager relationship is maintained by its own encrypted scheme.

Installation was similar to the other Windows NT firewalls: straightforward and uneventful. In contrast to the other products, however,

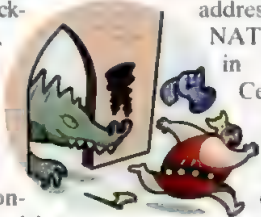
the setup of security rules took less time because of Guardian's Strategy Wizard. First-time guidance for the security process—and the templates Guardian has for agents and services—are features we'd like to see in other products.

To protect against spoofing, Guardian has an optional mechanism called network address translation, or NAT (\$1,980), also found in Global Internet's Centri Firewall, that keeps network IP addresses private. An outsider sees only the IP address of the firewall.

Guardian's most appealing feature, though, is the real-time monitoring agents that graphically show total available and current consumption of your Internet link's band-

width. The Activity Monitoring screen allows you to view connections by IP address or name, bytes sent and received, type of activity, and the percentage of bandwidth occupied by a user. You can assign limits that, if exceeded, generate alerts. In addition, we were able to terminate sessions and suspend specific services easily. But the alerting functions, which also report on suspicious activity, appear only at the Management console. E-mail, pager, SNMP, and other alerting options, such as those found in Eagle NT and FireWall-1, are not available in Guardian. —JGW

Guardian 2.0. List price: For 50 users, \$3,980. NetGuard Inc., Carrollton, TX.; 214-738-6900; www.netguard.com. Circle 959 on reader service card.



MULTIPLE ACCESS By Steve Buehler

Shakin' the TCO Blues



Total cost of ownership. I hear lots about this nowadays, especially when people are comparing desktop PCs with almost-ready-for-prime-time network computers (NCs). But total cost of ownership (TCO) means different things to different people, and sorting out real costs from guesstimates is pretty tough.

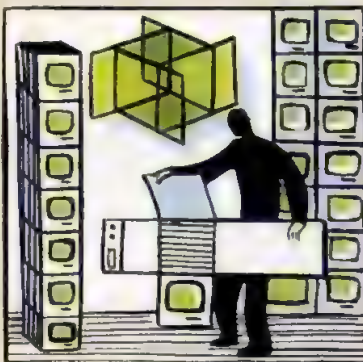
Industry analysts from The Gartner Group have published studies showing that the TCO for a desktop computer can start at \$8,000 and run to more than \$12,000 per year. Savings of several hundred dollars per PC multiplied by the hundreds or thousands of PCs can quickly add up to serious money. Conversely, underestimating the cost of system upgrades and migrations can severely affect your company's bottom line and your long-term career growth. So where do you go for help?

You could always pull up a spreadsheet and make up costs for goods and services. But a better answer is the recently updated Client Server Solution Advisor from Interpose (407-260-5551, www.interpose.com). Once you get past its awkward name, you'll find that the CSSA is a well-designed and -executed product. It's part network discovery tool, part spreadsheet, and part coach for planning and proposing network upgrades, migrations, and maintenance.

CSSA, Version 2.0 looks at your network, checks out what's attached and where, and figures out such basics as CPU types and memory for the PCs and servers you have. You can then take this information, use the supplied CSSA figures for growth, and estimate how much you'll spend keeping your users happy. CSSA's new features are impressive. You can use templates to plan new network infrastructure and NOS migrations, and the software gives you all the charts, graphs, and justifications you need to silence the bean counters. CSSA includes templates for upgrading to IntraNetWare and Windows NT 3.51, so it's a handy tool for network administrators trying to keep up with changes in the industry.

As a starting point, you can use CSSA's suggested numbers, or you can do countless what-if analyses based on numbers more appropriate to your situation. With the complete picture in front of you, determining how much benefit you can get out of planned IS changes and upgrades is pretty easy. After you finish your analysis, CSSA can give you a project plan—in Microsoft Project format—so you can get started. If you're thinking of using NCs, CSSA can help you figure out if they make economic sense for your environment.

Oh, and the funniest part about TCO? According to those in attendance, it was listening to Microsoft execs at their recent Developers' Conference talk about the importance of thin NC clients. If the guys who brought you 30MB desktop OSs and 100MB office suites can spin this fast, you'd best be prepared to change too. Luckily, you have CSSA on your side.



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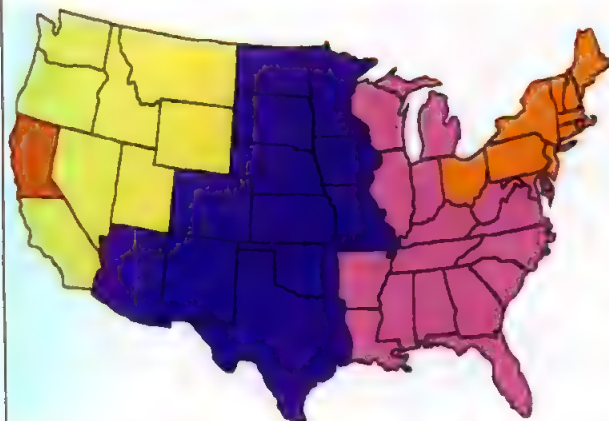
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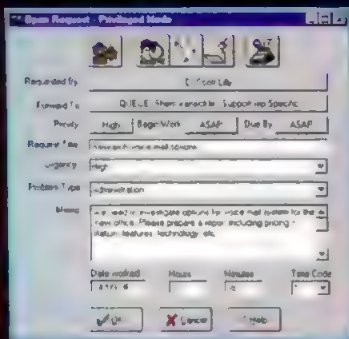


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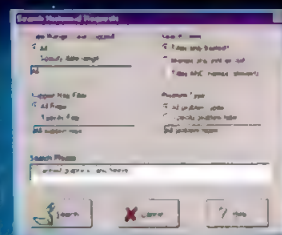
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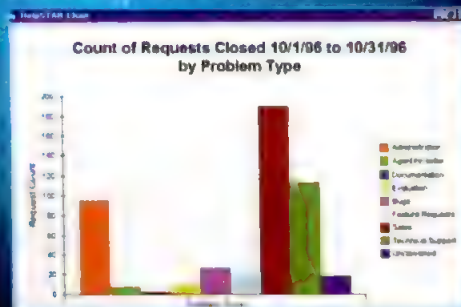


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Large fonts under Windows 95. © Monster Truck Madness Microsoft Corp. Monster Truck Madness was tested in first person view, with dashboard off, map off, sky texture on, horizon on, smoke effects on, image quality high, texture normal, scenery complex, shadow normal, smoothing on, two tracks and particles. Test conducted at full screen 640 x 480 @ 16 bit. Score indicates maximum frame rate. Direct 3D tests done using Tunnel from the DirectX 2.0 SDK. Diamond Stealth 3D 2000GL and ATI 3D Xpresson + PC2TV tests were conducted at 512 x 384 @ 16 bit while Matrox Mystique tests were conducted at 640 x 400 @ 16 bit based on Gouraud shaded, perspective correct textured, point sampled, 16-bit per pixel color, dithered rendered polygons.



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Even though many of today's leading productivity applications will not be optimized for MMX in the near term (including the three major office suites from Microsoft, Lotus, and Corel), the MMX Pentium CPU is still big news for businesses. Its extra L1 cache boosts performance an average of 10 to 20 percent, depending on the PC (as measured by our benchmark test program 3D Winstone 97, which contains no MMX-enabled applications).

MMX EXTENDS

Intel's fifth-generation CPU just got a face-lift: 57 new instructions for speeding multimedia tasks. PC Labs tests 12 of the first Pentium PCs with MMX Technology.

By Cade Metz

The microprocessor is having an identity crisis. For almost 14 years, the evolution of the Intel CPU was as linear as an Old Testament genealogy: The 8088 begat the 286, which begat the 386, which begat the 486, which begat the Pentium. Each new model was faster than the one before and thus could better satisfy end-user needs of any kind. But ever since the Pentium Pro's arrival, the microprocessor's identity, once easily defined by clock speed, has been in crisis. Matters are even more perplexing now that Intel has introduced the Pentium Processor with MMX Technology.



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Whether you're playing games or working with image-editing software on your home PC, the MMX Pentium is quite a boon. The MMX instruction set is geared specifically toward speeding the processing of these types of data, and our tests prove that it significantly boosts performance and lowers CPU utilization. Software that supports MMX will also be bountiful, in the form of games, image-editing packages, MPEG players, and voice recognition software.

THE DESKTOP

MMX, the first major change to Intel's x86 architecture since the advent of the 386 chip over a decade ago, consists of 57 new instructions designed to enrich and accelerate multimedia and communications on the PC (see the sidebar "How MMX Technology Works"). Software coded to use MMX may show striking improvements in such tasks as audio and video playback, image processing, and 3-D rendering. Beginning with the Pentium Processor with MMX Technology—whose enlarged primary cache boosts performance on standard applications—Intel will incorporate the new instruction set into all of its future processors.

THE FIRST MMX ROUNDUP

In this—the industry's first major roundup of PCs with Intel's newest Pentium processor, which has both MMX extensions and 32K of L1 cache—we review 12 200-MHz MMX systems from 11 leading PC vendors. Each has at least 32MB of RAM (business-oriented machines came with 64MB for testing with Adobe Photoshop), a 2GB or larger hard disk, a 6X or faster CD-ROM drive, a 16-bit sound system, speakers, and a Super VGA graphics card. Seven of the machines are designed for business use and five for home use.

We tested each PC with both our standard benchmark

MMX Outperforms Pentium

How much of a performance boost do you get when shifting from the Pentium processor alone to the Pentium with MMX Technology? On the business side of the fence, we saw a minor gain of about 8 percent on today's popular applications, as measured by our ZD Business Winstone 97 tests. The performance gap among home PCs was more dramatic: The average unit here beat the average machine from our most recent roundup of home PCs (December 17, 1996) by 15 percent on the Winstone tests. The one MMX Pentium/166 system that we tested, a business machine, produced a surprising result. It performed roughly on a par with the Pentium/200 business PC with MMX, and it topped the home PCs both with and without MMX.

ZD Business Winstone 97

Higher scores represent better performance

Average MMX Pentium/200 business PC (current issue) **43**

Average MMX Pentium/200 home PC (current issue) **38**

MMX Pentium/166 business PC (Micron Millennia MXE P166) **41**

Pentium/200 business PC (Micron Millennia MXE P200) **40**

Average Pentium/200 home PC (12/17/96) **33**

test suites and an eclectic set of MMX applications, including Adobe Photoshop and PhotoDeluxe, Kai's Power GOO, and Vream's WIRL VRML browser. With one home machine (the HP Pavilion 7370V) and one business system (the Micron Millennia MXE P200), we removed the MMX chip, adjusted the voltage regulator, and tested with a classic Pentium/200. When running Winstone, the MMX Pentiums outperformed their classic Pentium counterparts by 7.4 percent and 9.9 percent respectively. The increases on our MMX tests ranged from 35 to 500 percent (see the sidebar on this page, "MMX Outperforms Pentium").

Yet benchmark and stopwatch tests cannot show all the advantages of MMX. In addition to speeding up multimedia and freeing the processor for other tasks, MMX can help to enhance images, clarify audio,

and sharpen video. Caveat emptor: Early MMX-enabled titles are mostly games.

MARKET DYNAMICS

For the first few months of this year, three distinct chips, whose roles in the market are often indistinct, will vie for desktop PC space. The customary basis for deciding between Intel's fifth- and sixth-generation CPUs has been the operating system: You ran Windows 95 with a classic Pentium and a 32-bit OS (such as Windows NT or OS/2) with a Pentium Pro. But the arrival of the MMX Pentium makes such a litmus test obsolete, for it's designed specifically to boost multimedia performance, which transcends operating systems.

To be sure, the classic Pentium has been pushed to the midrange and low-end markets and will be phased out by year's end.

As our tests showed, the MMX Pentium outperforms the classic Pentium by roughly 10 percent for everyday applications and surpasses it even more when running the industry's nascent MMX software packages—a modest collection of titles that rely heavily on graphical rendering and sound (see the chart "MMX Software"). Users may choose to bypass add-in cards and enrich their multimedia with a relatively inexpensive, self-contained solution.

Although such appeal makes the MMX Pentium a leader in the home market, it does not necessarily give the chip a similar cachet in the corporate environment. Almost all of the first MMX-enabled software packages consist of games and edutainment titles that are appropriate only in the family den, not in the Wall Street corner office. The latter setting is best served by the desktop version of the Pentium Pro, which is not only less expensive than the MMX Pentium but also more adept at running Windows NT.

AN ARCHITECTURAL SHIFT

So that a generation of MMX software would arrive in tandem with the first MMX CPU, Intel publicly disclosed the technology last March, ten months prior to the processor's release. The company initially dubbed the chip the *P55C* but later gave it the long-winded title *Pentium Processor with MMX Technology*.

For the first time, Intel introduced a new chip's desktop and mobile versions on the same day. The two desktop CPUs run at 166 MHz and 200 MHz, and the mobile processor is available in 150-MHz and 166-MHz versions, the latter being the first mobile chip to run at such a clock speed.

Though the P55C plugs into the same socket as the classic Pentium and shares



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Editors' Choice

- Business PC: Dell Dimension XPS M200s
- Business PC: Micron Millennia MXE P200
- Home PC: Gateway P55C-200 FPC



This roundup of the first Pentium MMX PCs gave us just a glimpse of what lies in store for business and home PC buyers in 1997: faster performance, smoother multimedia playback, and adept image manipulation, all for little or no price premium over

today's Pentiums. In this group of 12 MMX PCs, three earn our Editors' Choice award.

The business PC category produced a photo finish between two of the contenders, so we awarded Editors' Choice to both the \$3,179 Dell Dimension XPS M200s and the \$2,848 Micron Millennia MXE P200.

The Dell Dimension XPS M200s packs lots of great hardware, including a 3GB IBM hard disk (which garnered the roundup's top Disk WinMark score), a Matrox Millennium graphics adapter hooked to a 17-inch monitor, and a 12X CD-ROM drive. Extra perks include an Iomega Zip drive with three 100MB cartridges and a 33.6-Kbps modem.

Two words describe Micron's Millennia MXE P200: *awesome performer*. The Millennia posted the roundup's best scores on three out of four Photoshop tests, on the Kai's Power GOO test, and on

CD-ROM WinMark 97. This PC features a Diamond Stealth 3D graphics board, a 17-inch monitor, and a 12X CD-ROM drive. By the time you read this, it will include an Iomega Zip drive and a larger, 2.5GB hard disk at no extra cost.

Our Editors' Choice in the home PC category is the \$2,918 Gateway P55C-200 FPC. It was a stunning performer, besting its home PC competition on nearly every benchmark test measure and MMX application test. The P55C-200's hardware bundle includes a 17-inch monitor, a 33.6-Kbps modem, and a PC ProPad 4 game pad.

We also award an honorable mention to the Quantex QP5/200 SM-3 from Quantex Microsystems. Included in its \$3,399 price is a huge 4.1GB Ultra SCSI hard disk, a 12X CD-ROM drive, and a 33.6-Kbps modem. The system was also a leading performer in this roundup.



The Gateway P55C-200 FPC is a great family choice.



Dell's Dimension XPS M200s is loaded with crowd-pleasing hardware.



Micron's Millennia MXE P200 was our top MMX performer.

its name, the new CPU's design is a decisive departure. Whereas the classic Pentium has 16K of L1 cache, the MMX chip has 32K, which means that it spends less time consulting the external L2 cache and the main memory. Together with several other enhancements unrelated to the implementation of MMX, this feature improves the performance of non-MMX-enabled applications by 10 to 20 percent.

But this improvement doesn't involve a higher consumption of power. Whereas Intel built the classic Pentium on a Bi-CMOS process, the P55C uses a 0.35µ purely CMOS process that forgoes power-hungry bipolar transistors. The chip's input and output pins interface at 3.3 volts, but its inner core has a much lower voltage: 2.8 volts for desktops and 2.45 volts for portables. Although a dual

voltage is the status quo for mobile chips, this is the first such implementation in a Pentium desktop design. Most motherboards have voltage regulators that vendors simply need to adjust to accommodate the new CPU.

At 141 mm², the P55C is 50 percent larger than the classic Pentium and thus costs more to produce. In 1,000-unit lots, the 166-MHz desktop P55C is \$407 per chip, and the 200-MHz version sells for \$550. With such figures, Intel's price structure becomes rather enigmatic: Although a 200-MHz Pentium Pro with 256K of on-board L2 cache offers better performance than a 200-MHz P55C or a 200-MHz classic Pentium, it sells for \$25 less than the

Our Contributors: CADE METZ is a staff writer and ROBERT S. ANTHONY is a senior writer for *PC Magazine*; NICK STAM is a technical director at PC Labs, and JOHN CLYMAN is a senior technical editor of PC Magazine Online. MARY E. BEHR and ANUSH YEGYAZARIAN are staff editors of *PC Magazine*. CAROL VENEZIA was the senior associate editor of this story, and MARGARET PIEMONTE was the project leader.

How MMX Technology Works

By John Clyman and Nick Stam

MMX extends the x86 instruction set by 57 new instructions. Although they do not apply only to multimedia, they were developed with the requirements of multimedia code in mind. For example, one instruction enables the processor to perform a high-speed multiply-accumulate function, which computes the sum of a series of products. This function is a central aspect of key algorithms used in digital signal processing (DSP) applications, such as telephony.

More broadly, MMX uses a technique called *single instruction, multiple data* (SIMD), which lets the CPU perform one calculation simultaneously on two, four, or even eight data elements without any decrease in speed. MMX accomplishes this feat by packing multiple operands (8-, 16-, or 32-bit values) into a single 64-bit register and operating on all of them in parallel. For example, a graphics program might place eight 1-byte (8-bit) color values into the register and instruct the CPU to add 10

to each of them, thus brightening their portion of the image. This operation can execute in a single clock cycle.

MMX operates on 64 bits at a time, whereas the general-purpose registers on Intel processors have only 32 bits; nevertheless, it does not require any new registers. Instead, it uses a portion of the processor's 80-bit floating-point registers. Because of this method, Intel recommends against mixing floating-point and MMX code; otherwise, you will limit performance. (Avoiding this approach should not present any problems for most applications.) Significantly, MMX does not inherit the clunky, stack-based mechanism that a floating-point unit uses to access the floating-point registers; an MMX instruction can directly address any of the MMX registers.

MMX also offers a variety of features that help programmers avoid branches in code. It thus reduces the incidence of performance-sapping pipeline stalls, which occur when the processor has to fetch code from an unexpected location. For example, MMX provides *saturating*

arithmetic, which caps the value of mathematical functions to prevent troublesome overflow conditions. MMX also lets programmers use *masks*, so that instructions operate on only some of the elements packed into the 64-bit register.

Most MMX instructions execute in one clock cycle. They qualify as simple instructions with regard to the Pentium's instruction-pairing logic and can thus take full advantage of the processor's superscalar capabilities. It is less clear how MMX will be integrated into the Pentium Pro's more complex design, and Intel is not yet providing any hints.

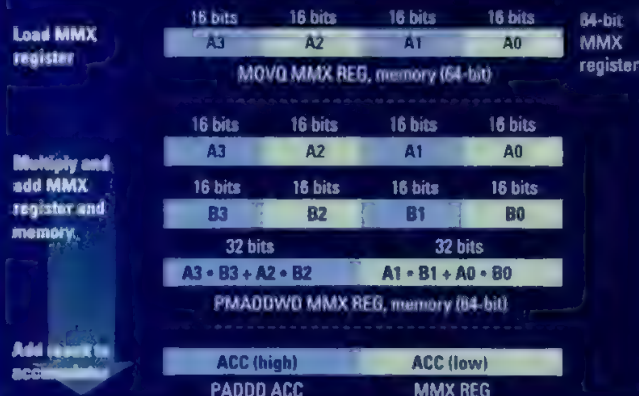
THE BOTTOM LINE

MMX extends the CPU's capabilities without altering its behavior when running existing code; hence the chips will be fully compatible with today's applications. For mainstream business programs, MMX has few performance benefits. But the demand for realistic multimedia is increasingly driving PC performance needs, and in that realm MMX offers immense promise.

Simple Multiply-Accumulate Operation

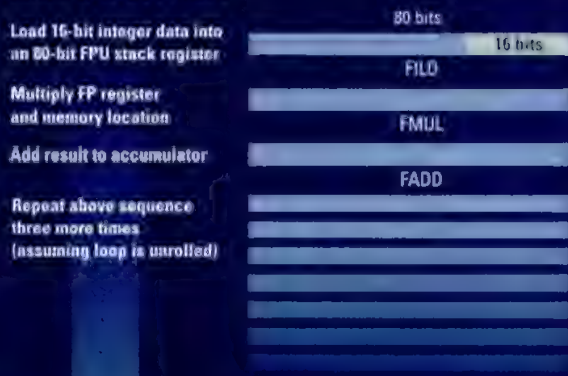
Pentium MMX Implementation (optimal)

Four 16-bit signed words in a source operand are multiplied by four others in a destination operand. The result is two 32-bit doublewords, with the two high-order words summed and stored in the destination register's upper doubleword and the two low-order words in its lower doubleword. Three MMX instructions are key to this operation: `MOVQ`, `PMADDWD`, and `PADDQ`.



Standard Pentium Implementation (optimal)

The standard Pentium requires at least 12 instructions to perform the same task that MMX executes with 3. The Pentium uses floating-point instructions, because the multiplies are significantly faster than integer multiplies. Intel claims that the MMX processor performs this type of operation five times as efficiently as the Pentium.





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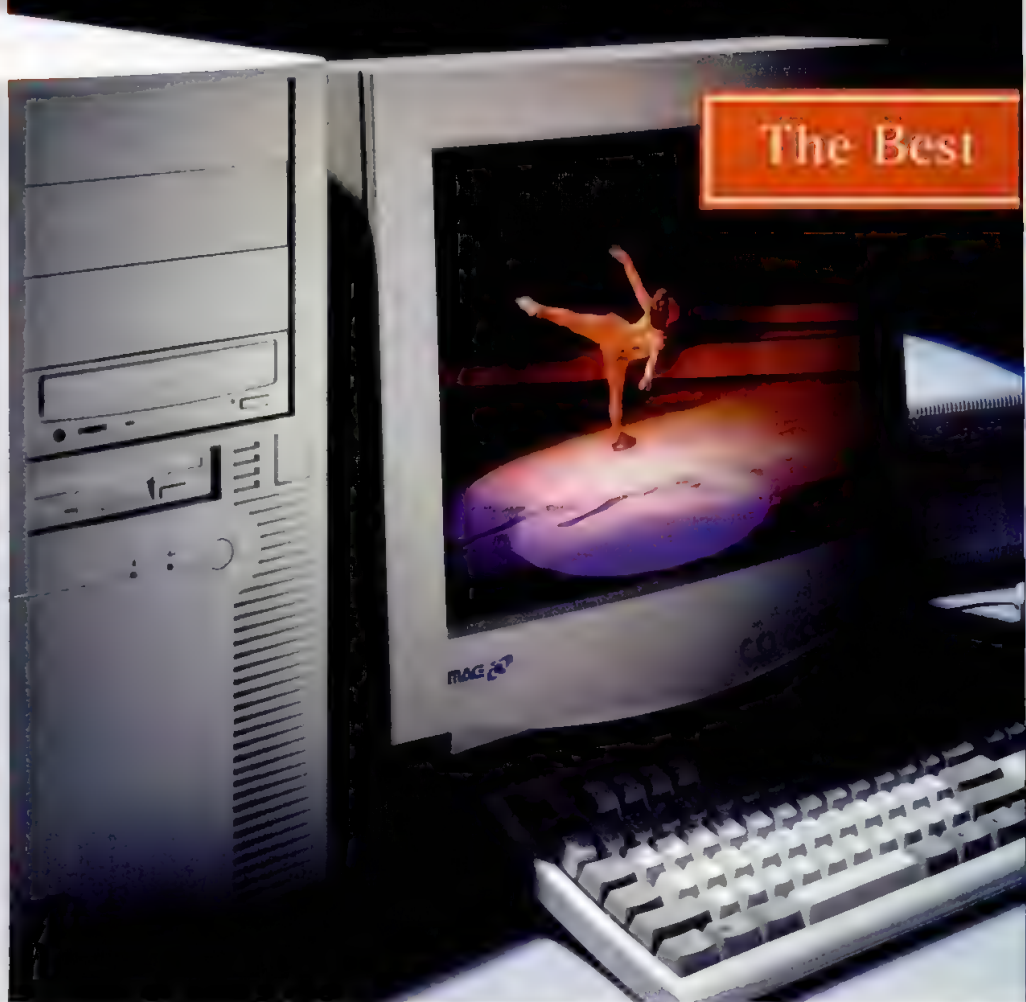
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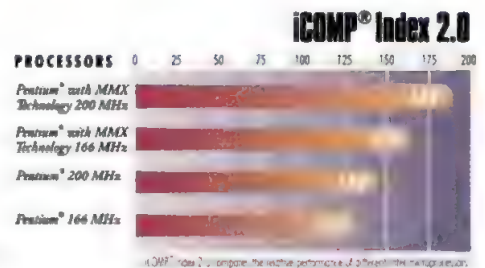
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PC Magazine, 12/3/96



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(Upgrade to Panasonic PD Drive for \$179)
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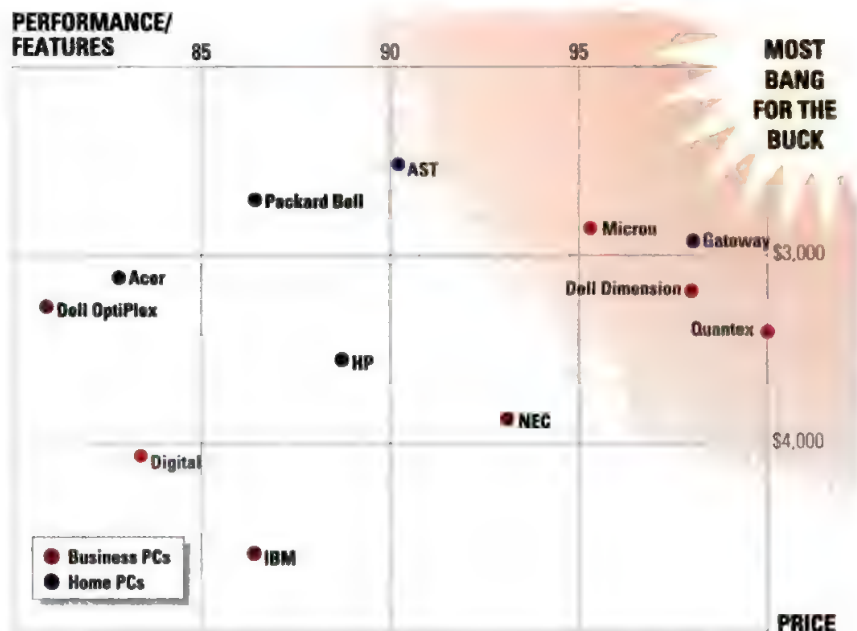
Price/Performance Index: MMX PCs

The \$3,399 Quantex QP5/200 SM-3, which earned this roundup's highest performance/features score, is an attractive choice for businesses. It offers much of the same hardware as Dell's Dimension and adds a 4.1GB Ultra SCSI hard disk, a subwoofer for its Altec Lansing speakers, and a telephony modem.

Among home PCs, the \$2,918 Gateway P55C-200 FPC—an Editors' Choice—offers a great balance of price, features, and performance. It's loaded with 512K of L2 cache, a 3.6GB hard disk, a 17-inch monitor, a 12X CD-ROM drive, a 33.6/14.4-Kbps fax modem, and a game pad. Top-notch performance, a three-year warranty with one year of on-site service, and a well-rounded software bundle make this unit hard to resist.

For price-conscious home buyers, AST's \$2,500 Advantage! 9320 is a good value. It features a 2.9GB hard disk, a 17-inch monitor, 256K of L2 cache, an 8X CD-ROM drive, a 33.6/14.4-Kbps voice modem with telephony features, and a graphics subsystem anchored by S3's ViRGE chip set. An attractive software bundle includes Lotus SmartSuite, Quicken SE, and some MMX-enabled titles.

Business buyers should be pleased with either of our two Editors' Choices in this category, the \$2,848 Micron Millennia MXE P200 or the \$3,179 Dell Dimension XPS M200s. Both



offer 17-inch monitors, 12X CD-ROM drives, and three-year warranties. Both were also great performers on our benchmark and MMX applications tests. For the extra money, the Dimension packs a slightly bigger hard disk (3GB versus the Millennia's 2GB), a 33.6/14.4-Kbps modem, and an Iomega Zip drive (by the time you read this, the Micron unit will ship with a larger hard disk and a Zip drive for the same price).—*Analysis written by Anush Yeghazarian*

THE DATA POINTS

Performance on our ZD Business Win-

stone 97 and ZD CD-ROM WinMark 97 tests accounts for 38 percent of the performance/features score, and the PhotoDeluxe, Kai's Power GOO, and VRML application test results form another 14 percent.

System components—including the capacity of the hard disk, monitor size (measured along the diagonal), and the amount of graphics memory—account for 22 percent. Warranty terms constitute about 11 percent. The rest of the score reflects many factors, including expansion options. You can find the relevant price/performance index data on our Web page, at www.pcmag.com.

former chip and only \$16 more than the latter. Clearly, a chip's worth is no longer defined by clock speed alone.

These figures don't necessarily correlate with system prices. As we were completing this story, the major direct vendors were selling Pentium Pro systems for about \$200 more than similarly equipped classic Pentium PCs. Once MMX enters the picture, expect to pay about \$50 to \$100 more than for a similarly configured classic Pentium.

CHOOSING A CHIP

Though mobile CPUs still trail their desktop counterparts in speed and ability, they

progress gradually in performance from the Pentium/100 to the 166-MHz MMX Pentium. By contrast, the hierarchy of desktop chips is more confounding than the line of succession in Shakespeare's *Richard III*.

The classic Pentium is still the industry's leading seller, and its 200-MHz version debuted just last June, but it does not offer the power of the MMX Pentium or the Pentium Pro. Indeed, Intel will likely phase out the classic Pentium by the end of 1997. Though the Pentium Pro will eventually be the industry's preeminent platform, only the MMX Pentium now has Intel's multimedia update to the x86

instruction set.

Though the MMX Pentium already anchors many corporate PCs (as it does half of the machines in this roundup), it is truly a consumer-market processor. The P55C is the first chip to arrive arm in arm with software designed to use its architecture, but that software is mostly for home users. VRML, Shockwave, and a few MPEG engines have adopted MMX, but such programs are mainly for Internet users seeking pop-cultural fun. With the exception of Adobe Photoshop and PhotoDeluxe (both photo editors) and Kai's Power GOO, today's MMX-aware

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Vendor Service & Reliability

We include ratings for those vendors for which we received at least 50 responses on our latest Service & Reliability survey of 17,000 *PC Magazine* subscribers. These results reflect readers' experience with desktop PCs from a given vendor.

We analyzed the data using a *t-test*, a standard procedure for identifying differences from the average that are significant at the 95 percent confidence level. For further details, see our July 1996 issue.

The **reliability** rating is a measure of respondents' satisfaction with the reliability of the vendor's desktops in use over the past two years.

The **repair** rating is a measure of respondents' satisfaction with the repair service provided by the vendor

for PCs in use over the past two years.

The **technical support** rating is a measure of respondents' satisfaction with the vendor's support for machines in use over the past two years.

The **units needing repair** rating is a

measure of the proportion of desktops that the respondents indicated needed repair during the past year. *Better than average* means that the incidence of needed repairs was significantly lower than average.

	SATISFACTION WITH			Units needing repair
	Reliability	Repair	Tech support	
○ Significantly better than average				
○ Average				
● Significantly worse than average				
Acer	○	○	○	○
AST	○	○	○	○
Compaq	○	○	○	○
Dell	○	○	○	○
Digital	○	○	○	○
Gateway 2000	○	○	○	○
Hewlett-Packard	○	○	○	○
IBM	○	○	○	○
Micron	○	○	○	○
NEC	○	○	○	○
Packard Bell	●	●	●	○

software consists strictly of games and edutainment titles.

In all likelihood, today's principal corporate titles will never adopt MMX. (In fact, Microsoft has no plans to enable its best-selling Office suite for MMX.) Only a multimedia activity, such as videoconferencing, is apt to make MMX relevant in the corporate space. Intel's Videophone now provides a better frame rate and a sharper image when used with an MMX chip, but it has yet to reach a level where it can readily be used for business purposes.

That leaves the Pentium Pro as the corporate market's chip. Not only does it provide the best performance per dollar, but it is far and away the most adept at running Windows NT, the heir apparent to the business operating-system crown. Windows NT has always provided full 32-bit performance, security, stability, and preemptive multitasking; with the debut of Version 4.0, it has the lucid Windows 95 user interface. Windows 95, like its comrade the classic Pentium, is becoming a consumer product.

FUTUREWATCH

Though Intel has no plans to produce a desktop MMX Pentium that exceeds 200 MHz, it may deliver a 200- to 233-MHz

mobile chip later in the year after shrinking the P55C die via a 0.25µ process. In the first half of this year, the company will ship a Pentium OverDrive CPU with MMX, which has a built-in voltage regulator and allows for easy upgrades of standard Pentium machines.

But the chip to hold your breath for may be *Klamath*, a Pentium Pro that supposedly forgoes an on-board L2 cache and adds MMX extensions: With it, you give up neither 32-bit nor multimedia optimization. For mobile users, Intel will finally offer a low-voltage Pentium Pro, the 0.25µ Deschutes, around the turn of the year. This chip, which is also an MMX design, will necessitate an overhaul of all portable motherboards and chip sets.

MMX AND THE COMPETITION

Sometime before midyear, both of Intel's principal competitors will bring MMX hardware to market as well. After merging with NexGen, AMD took over that company's Nx686 chip and rechristened it the *K6*. It has a 64K primary cache and a 0.35µ manufacturing process, and its speeds will eventually exceed 200 MHz. The chip has a Pentium pinout but is optimized for 32-bit operation, and AMD is therefore positioning it squarely as a competitor of the *Klamath*, not the Pentium.

AMD has cross-licensed the MMX instruction set from Intel and will include it with all versions of the *K6*.

Cyrix, always one to work from scratch rather than cloning Intel designs, has decided against a licensing agreement with the silicon giant and has created its own version of MMX. On the basis of past legal decisions involving Cyrix and the owners of its foundries, the company can include its rendition of MMX in its imminent M2 chip. Like the *K6*, the M2 has a Pentium pinout and 64K of on-board cache and is optimized for 32-bit code. It will offer 180- to 225-MHz clock speeds and a 2.5-volt inner core.

THE LAST WORD, FOR NOW

The P55C will surely be a major player in the home market. Those with scanners will benefit from MMX incarnations of PhotoDeluxe and Photoshop; joystick users will delight in POD and Rebel Moon Rising, and Web surfers will indulge in VRML and Shockwave. Even without MMX, the P55C can improve the classic Pentium's performance with its extra L1 cache. But corporate users who run Windows NT and depend less on multimedia should forgo MMX for the time being and opt for a Pentium Pro—or hold out for a *K6*, *Klamath*, or M2.

Premier Power Platform

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--- Windows Magazine, November 1996

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Acer America Corp.

Aspire P200 MMX

Like other Acer Aspires, the Aspire P200 MMX (\$3,100 street) is aimed at home multimedia users. It has many of the components and software programs that add to the line's appeal, such as a quick-start resume feature and ATI's 3D Rage II, a graphics chip set with 2MB of SGRAM to enhance games. Acer plans to keep Pentium PCs without MMX in its Aspire line, though most will be entry-level and midrange units, with slower CD-ROM drives and no 3-D graphics support.

Performance was mostly competitive within the home PC group. But the unit posted the roundup's lowest scores on the Winstone 97 and Graphics WinMark 97 tests. On our applications tests, the Aspire was on a par with its competition, and it delivered a better-than-average score on our PhotoDeluxe Unsharpen Mask test.

The Aspire has the line's familiar dark gray case, a 17-inch monitor with integrated speakers (a telephone handset and holder that attaches to the monitor is a \$29 option), a 33.6/14.4-Kbps modem, a 12X CD-ROM drive, and a 3.6GB hard disk.

The software bundle includes the ACE Windows 95 interface and productivity applications such as MS Works, MS Money, and Quicken SE. It also features some MMX-enabled applications, like Slamscape and DeathDrome 1.0.

For those who don't need top-notch performance, the Aspire offers lots of software and other accoutrements that should satisfy everyone in the family.—
Anush Yeghazarian

Aspire P200 MMX. Street price: \$3,100. Acer America Corp., San Jose, CA; 800-558-2237, 408-432-6200; fax, 408-922-2933; www.acer.com/aac. Circle 475 on reader service card.



Home PC: Aspire P200 MMX.

MMX Software

Below we list many of the currently available and upcoming MMX-enabled software packages. Although most are edutainment and game titles, image-editing packages will also be available. Popular suites and programs that will not be optimized for MMX in the foreseeable future include Corel WordPerfect Suite, Lotus SmartSuite, Microsoft Office Professional, and QuarkXPress.

Company	Application	Estimated release
APPLICATIONS SOLD SEPARATELY		
Adobe Systems Inc.	After Effects	1997
	PhotoDeluxe	Available now
	Photoshop	Available now
	Premiere	—
Books That Work Inc.	Visual Home	January 1997
Byron Preiss Multimedia Co. Inc.	The Timetables of Technology	January 1997
Corel Corp.	CorelDraw	January 1997
	CorelPaint	February 1997
Davidson & Associates Inc.	The Third Dimension	—
Dorling Kindersley Ltd.	The Ultimate Human Body 2.0 for MMX	January 1997
Epic MegaGames	Jazz Jackrabbit 2	—
	7th Legion	—
	Unreal	—
GT Interactive Software Corp.	Robot Moon Rising	January 1997
	Robot Moon Revolution	1997
Imagination Pilots Entertainment	Turnabout	January 1997
Maria Multimedia Inc.	Space Station Simulator	March 1997
MetaTools Inc.	Kai's Power GOU	Available now
APPLICATIONS BUNDLED WITH SYSTEMS		
Mediamatics Inc.	Mediamatics Arcade Pak	Available now
	DVDExpress Audio Player	January 1997
	DVDExpress A/V Player	January 1997
PureSpeech Inc.	Juggler	March 1997
Ubi Soft Entertainment	POI	January 1997
Yamaha Corp. of America	S-XG50C (a wavetable synthesizer)	January 1997

AST Computer

Advantage! 9320

AST Computer's Advantage! 9320 (\$2,500 street) is a home PC for the whole family, with an emphasis on multimedia functionality. The system features wavetable synthesis sound as well as an integrated S3 ViRGE 3-D graphics chip set to enhance the multimedia experience. The unit also boasts a good software bundle and competitive performance.

AST intends to phase out Pentium PCs without MMX from its Advantage! line by the end of March. But the vendor does not plan to offer MMX systems in its business-oriented Bravo line.

The Advantage! posted average scores on most of our tests. Its S3-based graphics subsystem earned it a below-average Graphics WinMark 97 score, however, although this subsystem contributed to the system's better-than-average result on our VRML World test.

The unit also includes a 17-inch monitor, a 33.6/14.4-Kbps modem, and an 8X CD-ROM drive. (The machine will come with a 12X drive by the time you read

this.) The Labtec speakers were unexceptional, but Altec Lansing speakers with a subwoofer will be standard on the line's higher-end PCs by January. To complete the package, AST includes a software bundle with programs such as Lotus SmartSuite, Quicken SE, and reference and children's titles. Two MMX-enabled applications, POD and 7th Level Helicops, also come with the unit.

This is a good system for the whole family, worthy of a close look.—*AY*
Advantage! 9320. Street price: \$2,500. AST Computer, Irvine, CA; 800-876-4278, 714-727-4141; fax, 714-727-9355; www.ast.com. Circle 476 on reader service card.



Home PC: Advantage! 9320.

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the tree died tuesday,
you need a boost,



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- TelePath® 33.6 Data/14.4 Fax Modem
- 7-Bay Charcoal-Colored PC Case
- Wireless Keyboard w/ Integrated EZ Pad™ Pointing Device
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- Four-Channel RF Receiver
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2100 S5-133

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- 1MB EDO Video RAM
- Zoomed Video Port
- 1.3GB Hard Drive
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- Modular 3.5" Diskette Drive
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- Lithium Ion Battery & AC Pack
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- Carrying Case
- MS Windows 95
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2200 S5-150

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- 2MB Video RAM
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- 85-Key MS Windows 95 Keyboard
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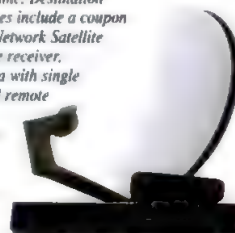
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ear muffs and socks
made of **miNk**,
tell the clerk, "they don't *fit* me"
and give him a **wink**.

use the cash to brighten
a year that's now
fizzless.

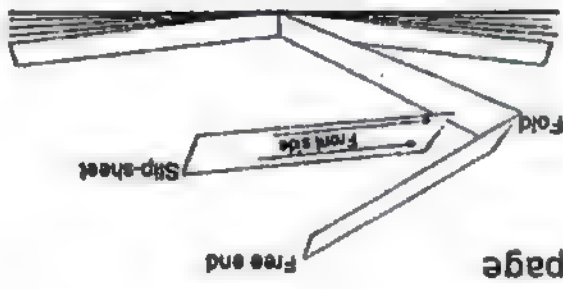
by placing a call to
"Your friends in the
business."



"You've got a friend in the business."®

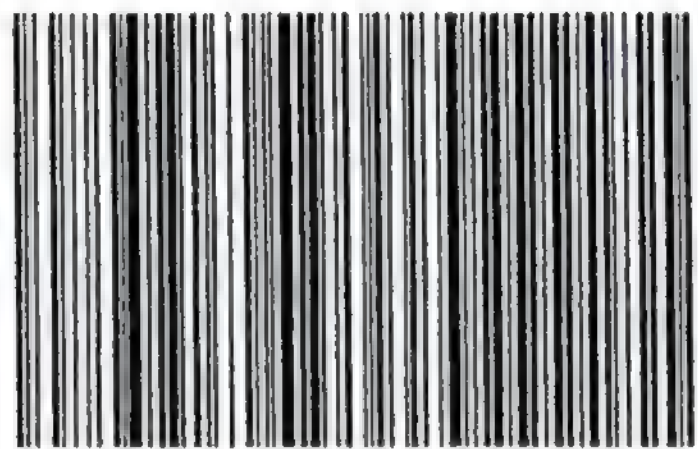
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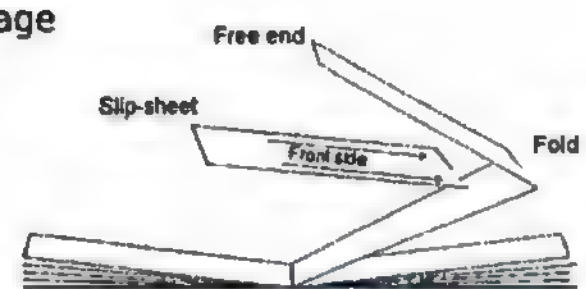


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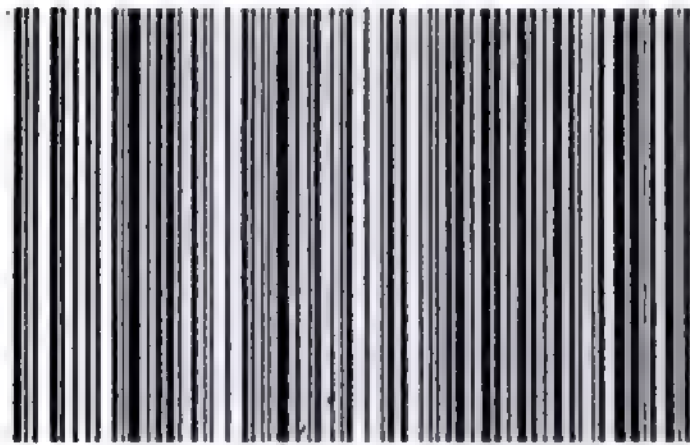
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1. Follow instructions on the other side

Inverted Back



Gbs5lpBack-001B

Back

1. Follow instructions on the other side

so WHAddYA **say,**
and put them **aWay.**

its needles **aSunder,**
a cow-spotted **wonder!**



post-HoLiday blues Aren't reALLy so **traGic,**
just caLL south dakota, we'll deliver some **MaGic.**

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- Mini Tower Case
- 104+ Keyboard & MS Mouse 2.0
- MS Windows 95
- Generations III Software Collection
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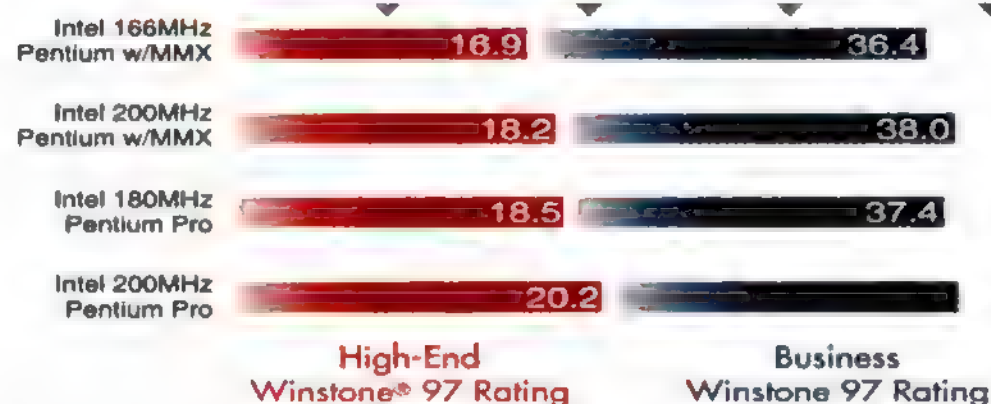
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Performance Graph



Ziff-Davis® Winstone 97 Version 1.0 produced scores of 16.9 and 36.4; 18.2 and 38.0; 18.5 and 37.4; and 20.2 and 42.7 Winstone Version 1.0 units on its Business Winstone 97 suite and High-end Winstone 97 suite on Gateway 2000, Inc. PCs configured with 166MHz Intel Pentium Processor with MMX technology, 200MHz Intel Pentium Processor with MMX technology, 180MHz Intel Pentium Pro processor and 200MHz Intel Pentium Pro processor, respectively. All Gateway 2000 PCs tested featured 32MB RAM, 256K RAM cache, 3.8GB hard disk, IDE controller, FAT file system, and no hardware disk cache. Systems include S3 ViRGE/VX graphics adapter, with 4MB VRAM with v1.23m3 driver, 1024x768 with 256 colors, and a refresh rate of 75Hz. Test systems used MS DOS 7.1 and MS Windows 95. All products used in the test were shipping versions available to the general public, and the test and its results were not verified by Ziff Davis.



Professional Systems

P5-133

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- 8X CD-ROM/3.5" Diskette Drives
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- 2MB SGRAM, 3-D 64-Bit PCI Graphics
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- 104+ Keyboard & MS Mouse 2.0
- MS Windows 95
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ultimate multimedia audio experience. **\$699**

G6-200XL featuring
new mini-tower case.



PERFORMANCE TESTS

MMX Pentium PCs



The combination of the MMX Pentium processor's extra L1 cache and 57 new instructions paid off on all our tests: We saw 10 to 20 percent better performance on non-MMX-optimized software and up to a sixfold boost on MMX-enabled applications.

What the Numbers Mean

Benchmark Tests

We ran our Winstone 97 and WinBench 97 tests on 12 200-MHz MMX systems, and added a suite of MMX applications tests based on newly released MMX software. For comparison, we also installed a standard 200-MHz Pentium CPU in both the HP Pavilion 7370V home PC and the Micron Millennia MXE P200 business PC. Our tests show that MMX can substantially boost performance for specific MMX-enabled application functions and results in roughly a 10 percent improvement for non-MMX application execution.

ZD Winstone 97 Tied for first place in the business PC division were the Digital Celebris FX 5200M and the Quantex QP5/200 SM-3. The Celebris's high mark can be partially attributed to its

4MB Matrox Millennium card. The QP5/200 SM-3 used an Ultra SCSI hard disk, 512K of L2 cache, and a Millennium board. Of the home PCs tested, the Winstone champion was the Gateway P55C-200 FPC. MMX versions of the HP and Micron units outperformed the Pentium versions by about 8.5 percent. (Note that the Winstone applications do not include any MMX code.)

ZD Graphics WinMark 97 The top scores were posted by two machines using 4MB PCI graphics cards based on S3's 3D-enabled ViRGE chip set: the Gateway P55C-200 FPC and the Micron Millennia MXE P200 (using the STB Velocity 3D and Diamond Stealth 3D 2000 cards, respectively). These systems were also strong performers on several of our MMX applications tests.

ZD CPUmark₃₂ Scores varied widely, from 349 (the last-place Acer Aspire P200 MMX) to 426 (the first-place Dell Dimension XPS M200s). The Dimension uses the Intel 430VX chip set, which supports synchronous DRAM. The Aspire uses standard EDO DRAM and the M1521/M1523 core-logic chip set from Acer Labs. Systems with only 256K of L2 cache posted noticeably lower results than those with 512K of cache.—*Analysis written by Margaret Piemonte*

MMX Applications Tests

Adobe Photoshop Using filters similar to those used for PhotoDeluxe testing (below), we tested under Photoshop at 64MB using 24-bit color. The Millennia edged out the Dimension, likely because of its finely tuned CPU, graphics, and disk subsystems. S3 ViRGE-based graphics helped the Millennia with fast 2-D blits and 24-bit color performance. The Dimension benefited from its fast hard disk. Because we used a 15MB file (and despite the fact

▲ Higher scores represent better performance.
▼ Lower scores represent better performance.
Bold type denotes first place within each category.

	ZD Business Winstone 97 Score	ZD Business Graphics WinMark 97 Score	ZD Business Disk WinMark 97 Thousand of bytes per second	ZD CPUmark ₃₂ Score	ZD CD-ROM WinMark 97 Thousand of bytes per second
HOME SYSTEMS					
Acer Aspire P200 MMX	33	41	624	349	856
AST Advantage! 9320	38	47	638	385	831
Gateway P55C-200 FPC	43	77	703	411	1,040
HP Pavilion 7370V	35	44	648	377	1,050
Packard Bell Platinum 2240	39	51	789	373	761
HP Pavilion (with a P/200)*	33	37	620	339	1,040
BUSINESS SYSTEMS					
Dell Dimension XPS M200s	44	66	897	426	882
Dell OptiPlex Gs 200	42	69	650	372	651
Digital Celebris FX 5200M	45	66	742	421	851
IBM PC 350	43	59	764	416	361
Micron Millennia MXE P200	43	77	806	420	1,090
NEC PowerMate P2200M	41	59	715	412	635
Quantex QP5/200 SM-3	45	66	810	417	1,080
Micron Millennia (with a P/200)*	40	60	773	392	1,070
	BETTER ►	BETTER ►	BETTER ►	BETTER ►	BETTER ►

* Reported for comparison. ⊗ This unit's performance was too poor to measure (1) With an Action, Indeo, 160-by-120, 30-fps, 300-Kbps clip (2) With an Action, Cinepak, 640-by-480, 30-fps, 900-Kbps clip

that we had a 64MB memory configuration), the disk was still constantly hit, especially on our Gaussian Blur test. When comparing the Micron MMX and standard Pentium configurations, we discovered that both our radius setting of 10 and the disk effect dampened the MMX improvement on the Gaussian Blur test, but performance on the Facet and Unsharpen Mask tests showed threefold and sixfold improvement, respectively.

Adobe PhotoDeluxe Our PhotoDeluxe tests were sensitive to the amount of system RAM and the size of the TIFF file. Our 15MB TIFF file used in a 32MB RAM configuration caused substantial disk swapping, reducing the impact of MMX technology. Increasing system RAM to 64MB and reducing TIFF file size to 9MB removed the disk bottleneck and showed that MMX can let a system really fly. Among the MMX systems, the Quantex QP5/200 SM-3 outperformed all others by a fair margin when performing two out of three tested functions.

When we tested an MMX PC accidentally received a few months back, we noted a best-case improvement of 22 percent under some MMX-enabled PhotoDeluxe filters. By selecting different MMX-enabled filters and varying filter parameters, we saw some significant speedups. We noted an astonishing improvement on the Unsharpen Mask test using 64MB of RAM and a 9MB TIFF file. Depending on the radius setting for the Soften Image test, improvements varied from 9 percent to 400 percent! We also tested two systems with 64MB of RAM using both a 15MB TIFF file and a 9MB TIFF file and varying radius settings on the Soften Image filter to demonstrate how timings can be improved (see the PhotoDeluxe chart at the end of this sidebar).

Kai's Power G00 Systems with 512K of L2 cache outperformed

CD-ROM Sequential 16K Read (Thousands of Bps) ▲	Access Time (ms) ▼	CPU Utilization (percent) ▼	Full-Screen Scaling ¹ Frames Dropped ▼	High- Quality Action Cinepak ² Frames Dropped ▼
1,420	157	72	0	362
1,220	145	30	0	84
1,010	136	45	0	0
1,450	139	38	0	0
1,220	164	32	0	0
1,460	138	36	0	0
1,010	160	46	1	0
984	189	34	75	61
1,220	137	64	0	⊗
1,020	175	5	0	130
1,350	95	64	0	20
952	187	30	0	116
1,750	131	70	0	128
1,350	96	64	0	16

those with 256K across the board. The Millennia's strong showing on our CPUmark₃₂ tests and its Diamond Stealth 3D 2000 board helped it step ahead of the other 512K PCs by a small margin. MMX effectively doubled systems' Goovie frame rates over rates achieved by standard Pentium configurations of the HP and Micron units.

PC Magazine Labs VRML World Running with Direct3D RGB emulation mode, all the MMX systems performed similarly in terms of frame rate. Compared with a standard Pentium running RGB emulation, the MMX machines were about 1.6 to 1.7 times as fast. When we tested with true 3-D hardware rendering (using the HP machine's S3 ViRGE 3Dfx graphics and the NEC PowerMate P2200M's ATI Pro Turbo Rage-GT), we saw the performance increase to roughly 2.6 times what was achieved by the MMX software emulation solutions. Microsoft developers inspected our tests and noted that they used bilinear texture filtering, which is not yet accelerated well by their MMX RGB emulation code.

MPEG Tests We ran CompCore's MMX-accelerated, software-based MPEG-II player and Mediomatics's MPEG-I player to measure the number of dropped frames and the CPU-utilization impact of MMX (though the results are not charted). MPEG-II pegs CPU utilization at nearly 100 percent (as expected and verified by CompCore). We could not measure dropped frames reliably. One item to note is that MPEG-II video can be played on MMX systems reasonably well but not on standard Pentium units.

Results on the Mediomatics MPEG-I tests varied among the standard Pentium systems: from 85 to 99.5 percent CPU utilization and from fewer than 20 to more than 500 dropped frames. (Mediomatics told us that the AQ=1 parameter must be set for Pentium playback to ensure that the quality level is comparable to the MMX default quality setting.) CPU utilization of the MMX Pentiums ranged from 42 to 93 percent (averaging 67 percent), and no unit dropped a significant number of frames.—*Analysis written by Nick Stam*

How We Tested

We tested the PCs with 1.6GB hard disks or larger, 6X or faster CD-ROM drives, and 32MB of RAM. (For our Adobe Photoshop tests, run only on the business PCs in this roundup, we used 64MB of RAM and 4MB of graphics memory.) We worked with each vendor's preinstalled graphics driver for 1,024-by-768 resolution, small fonts, and a refresh rate of 75 Hz.

We used our benchmark test program ZD Winstone 97, Version 1.0, to measure the machines' performance when running 32-bit Windows 95 applications. This suite consists of **ZD Business Winstone 97** and **ZD High-End Winstone 97**; in this roundup, we ran only the Business Winstone tests, which time a PC as it executes a set of scripts exercising eight best-selling Windows 95 applications. Business Winstone weights the timings based on each application's unit market share, derives a composite number, and converts it to a score relative to the performance of a Gateway 486DX2/66 with 16MB of RAM (whose score is defined as 10).

ZD WinBench 97, Version 1.0, measures graphics, disk, CPU, CD-ROM, and motion video performance under Windows 95. Like our Winstone test program, ZD Graphics WinMark 97 and ZD Disk WinMark 97 are each divided into business and high-end sections. In this roundup, we ran only the business portions. The **ZD Business Graphics WinMark 97** score, which is based on a log of GDI operations in the Business Winstone 97 tests, refers to the graphics subsystem's performance under Windows 95. We normalize the scores to make them relative to that of the base system

Continues

PERFORMANCE TESTS

▲ Higher scores represent better performance.
▼ Lower scores represent better performance.
Bold type denotes first place.

ADOBE PHOTOSHOP

ADOBE PHOTODELUXE

**Kai's Power
GOO**
Frames
per second ▲

**PC Magazine
Labs VRML
World**
Frames
per second ▲

Facet
Seconds ▼

**Gaussian
Blur**
Seconds ▼

**Unsharpen
Mask**
Seconds ▼

Facet
Seconds ▼

**Soften
Image**
Seconds ▼

**Unsharpen
Mask**
Seconds ▼

BUSINESS SYSTEMS

Dell Dimension XPS M200s	14.9	26.5	3.9	36.4	42.0	21.6	18.2	4.8
Dell OptiPlex Gs 200	16.4	43.6	5.2	36.3	43.1	23.1	17.5	4.5
Digital Celebris FX 5200M	16.8	26.0	5.0	37.5	40.3	26.2	18.1	4.7
IBM PC 350	16.0	37.0	5.0	33.5	40.5	19.7	18.0	4.9
Micron Millennia MXE P200	14.5	24.5	3.2	36.5	41.1	23.2	18.5	4.7
NEC PowerMate P2200M	15.2	36.0	5.3	33.8	41.9	21.4	18.1	4.6
Quantax QP5/200 SM-3	16.4	31.2	8.0	31.2	37.2	17.8	18.2	4.8
Micron Millennia (with a P200)*	40.7	27.4	19.0	68.5	45.5	36.4	8.8	2.8

* Reported for comparison

Continued

we use for Business Winstone testing. The **ZD Business Disk WinMark 97** score, based on a log of disk functions in the Business Winstone tests, represents the disk subsystem's performance under Windows 95. We report Disk WinMark results in thousands of bytes per second.

The **ZD CPUmark₃₂** score reflects the speed of each PC's processor subsystem under 32-bit OSs. The component tests emulate the CPU activity in real-world applications.

The **ZD CD-ROM WinMark 97** tests are based on a profile of six of today's most popular Windows CD-ROMs. We also report results of the **CD-ROM Sequential 16K Read** test, which measures the CD-ROM subsystem's throughput as it reads 16K blocks of data on a CD-ROM. The **CD-ROM Access Time** test evaluates the CD-ROM drive as it randomly accesses 2K blocks from the entire CD-ROM. The **CD-ROM CPU Utilization** score represents the percentage of the CPU's bandwidth occupied by servicing the CD-ROM subsystem as it retrieves data. To determine the utilization, WinBench 97 uses a default block size of 16K. The transfer rate defaults to the CD-ROM subsystem's maximum rate, which WinBench 97 calculates before it runs the test.

WinBench 97 also includes a suite of video clips for measuring a PC's ability to play full-motion .AVI files. The **Full-Screen Scaling**

tests use an Action, Indeo, 160-by-120, 30-fps, 300-KBps clip; the **High-Quality Action Cinepak** tests use a 640-by-480, 30-fps, 900-KBps clip. For both tests, we report the number of frames dropped.

Applications Tests

We tested the business PCs with **Adobe Photoshop, Version 4.0**, loading them with 64MB of RAM and using 4MB of graphics RAM to obtain 24-bit color at 1,024-by-768 resolution. We present results for three Photoshop filters that use MMX instructions: **Facet**, **Gaussian Blur**, and **Unsharpen Mask**. The Facet test sharply defines a selection by clumping pixels of similar color values in cells. The Gaussian Blur test blurs an image by an adjustable amount, adding low-frequency detail, and it can produce hazy or completely blurred effects; we applied a blur of radius 10. The Unsharpen Mask test accentuates object edges by varying the contrast between pixels. For this test we left the amount setting at 50 percent, the radius at 1.0 pixels, and the threshold at 0 level—the default settings. We applied all filters to a 15MB TIFF file.

Under **Adobe PhotoDeluxe, Version 4.0**, we tested all systems with 32MB of RAM except where indicated. For graphics RAM, 2MB was enough to produce our test resolution of 1,024-

Continues

Dell Computer Corp.

**Dimension XPS M200s,
OptiPlex Gs 200**



From a design standpoint, Dell Computer's Dimension XPS M200s (\$3,179 direct) and OptiPlex Gs 200 (\$3,265 direct) are impressive machines. (With an upgrade to 64MB of RAM, the systems sell for \$3,479 and \$3,565, respectively.) Both units also offer competitive performance, although the Dimension fared better than the OptiPlex on a number of tests. OptiPlex units have optional networking features

and are aimed at corporate users, whereas Dimension PCs, with their 12X CD-ROM drives and high-end audio subsystems, are targeted at small and medium-size busi-



Office PC: Dimension XPS M200s.

nesses. The Dimension was a price/performance leader in this roundup, and it earns a well-deserved Editors' Choice in the business systems category.

OptiPlex PCs offer Dell's convenient (and recyclable) OptiFrame slimline chassis. Internal components pull out or swing away easily, affording clear access to the motherboard. The value-priced OptiPlex that we received came with an optional 16-bit audio card and integrated Ethernet, although it lacked some features of the higher-end OptiPlex GXi line, such as USB ports and DMI compliance. The unit also came with a pair of Altec Lansing speakers and a 15-inch Dell mon-



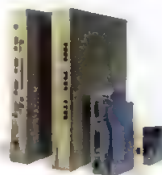
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PERFORMANCE TESTS

▲ Higher scores represent better performance.
▼ Lower scores represent better performance.
Bold type denotes first place.

ADOBE PHOTODELUXE

	Facet Seconds ▼	Soften Image Seconds ▼	Unsharpen Mask Seconds ▼	Kai's Power GOO Frames per second ▲	PC Magazine Labs VRML World Frames per second ▲
HOME SYSTEMS					
Acer Aspire P200 MMX	38.5	43.5	22.0	16.4	4.0
AST Advantage! 9320	40.2	43.5	23.1	16.4	4.4
Gateway P55C-200 PPC	36.2	41.3	22.2	18.1	4.7
HP Pavilion 7370V	39.1	44.4	27.2	17.8	4.3
Packard Bell Platinum 2240	38.0	43.4	31.8	17.6	2.7
HP Pavilion (with a P/200)*	71.8	48.6	42.6	8.6	2.5

* Reported for comparison

Continued

by-768 as well as 16-bit color depth. Using a 15MB TIFF file similar to the one used in the Photoshop tests, we stressed the disk subsystems with a great deal of swapping during the Gaussian Blur filter. We employed essentially the same three filters and settings as in the Photoshop tests, but the filter akin to Photoshop's Gaussian Blur is called **Soften Image** in PhotoDeluxe.

MetaTools' **Kai's Power GOO** is an entertainment program that can distort and stretch images on-screen, as you would with images transferred to Silly Putty. It also allows you to create an animation, or *Goovie*, by concatenating distorted images

or frames and running them as a movie. An MMX CPU, rather than accelerating the Goovie's speed, allows the generation of more frames per second so that the Goovie runs more smoothly. MetaTools' Ben Weiss and Peter Rothman crafted a special version of Power GOO for PC Labs that can count the frames per second during a Goovie, and we use this number for each unit's Kai's Power GOO test result. We tested the PCs with 32MB of RAM at 1,024-by-768 resolution with 16-bit color.

Using Radiance's Ez3d VRML Author Pro with VRML 1.0, we modeled a VRML world based on blueprints of PC Labs. We assembled and optimized it with Integrated Data Systems' V-Realm Builder by the Infomaniacs, with the help of VREAM's Ben DeWaal. For the **PC Magazine Labs VRML World** test, we use VREAM's Direct3D-based browser WIRL to navigate our world and to measure the frame rate. We have created a cyclical path through the model to derive accurate measurements. We test all PCs with 32MB of RAM at 640-by-480 resolution with 16-bit color, which is common for VRML worlds and 3-D game environments.

ADOBE PHOTODELUXE

■ 9MB TIFF file
■ 15MB TIFF file

Bold type denotes first place for each TIFF file size.

HP Pavilion 7370V (MMX)

HP Pavilion (with a P/200)

Micron Millennia MXE P200 (MMX)

Micron Millennia (with a P/200)

**Soften Image
Radius 10**
Seconds

16.4
30.6

19.3
38.6

18.6
27.2

18.3
29.4

**Soften Image
Radius 2**
Seconds

3.8
N/A

20.0
N/A

2.5
N/A

18.3
N/A

Facet
Seconds

12.5
21.9

33.5
56.9

11.7
19.7

31.6
56.3

Motion Blur
Seconds

45.9
65.6

76.2
102.9

36.8
49.8

64.1
90.1

**Unsharpen
Mask**
Seconds

3.7
6.1

16.3
27.5

2.4
4.5

14.7
25.4

◀ BETTER

◀ BETTER

◀ BETTER

◀ BETTER

◀ BETTER

We tested each system with 64MB of RAM. N/A—Not applicable: We did not run this test with the 15MB TIFF file.

itor. The integrated graphics subsystem was bypassed in favor of a 4MB PCI graphics board, the Number Nine Imagine 128 Series II.

The Dimension midtower's most salient feature is its internal Iomega 100MB Zip drive, which comes with three cartridges. The system also offers a Matrox Millennium graphics board; a 33.6-Kbps voice modem; audio provided by a wavetable card from Creative Labs, the Sound Blaster AWE32; a pair of Altec Lansing speakers; and a 17-inch Dell monitor. In addition, Dimension XPS units come with a software bundle that includes Microsoft Office Professional.

Both of the Dell machines were strong performers on most of our tests, although the Dimension surpassed the OptiPlex on several test suites. On our



Office PC: OptiPlex 6s 200.

Disk WinMark 97 tests, the Dimension earned the roundup's highest score using its 3GB IBM hard disk, but the OptiPlex produced a score below par with its 2GB Quantum hard disk. The Dimension also outperformed the OptiPlex on our CD-ROM WinMark 97 tests: Its 12X CD-ROM drive helped it to an above-average score, whereas its sibling's 8X drive produced a below-average score. On our applications tests, the Dimension again fared better than the OptiPlex, earning better-than-average scores on our Photoshop Gaussian Blur and Unsharpen Mask tests; the OptiPlex posted a worse-than-average score on the Photo-

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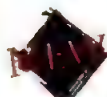
Pentium® processor, PCI Bus, 256K L2 cache, 16MB RAM expandable to 128MB, 28.8K internal modem, 2 PC Card slots with PC Card Bus and Zoomed Video, Win 95 keyboard, Li-Ion battery, Multi-function bay: 8X CD-ROM and modular FDD (std.), second HDD (opt.)



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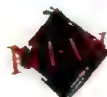
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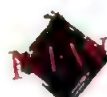
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MMX Pentium PCs

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PC MAGAZINE
EDITORS' CHOICE

■ YES □ NO

In alphabetical order by company

	Acer Aspire P200 MMX	AST Advantage! 9320	Dell Dimension XPS M200s	Dell OptiPlex Gs 200	Digital Celebris FX 5200M	Gateway P55C-200 FPC	HP Pavilion 7370V
Price of tested configuration	\$3,100 (street)	\$2,500 (street)	\$3,179 (direct)	\$3,265 (direct)	\$4,060 (street)	\$2,918 (direct)	\$3,550 (street)
System type	Home	Home	Business	Business	Business	Home	Home
Installed system RAM	32MB EDO	32MB EDO	32MB SDRAM	32MB EDO	32MB EDO	32MB SDRAM	32MB EDO
Hard disk	Quantum Fireball TM3840A	Western Digital Caviar AC33100	IBM DAQA-33240	Quantum Fireball TM2110A	Quantum Fireball TM2110A	Quantum Fireball TM3840A	Quantum Bigfoot CY4320A
Capacity and interface	3.6GB Fast ATA-2	3GB EIDE	3GB ATA-3	2GB Fast ATA-2	2GB Fast ATA-2	3.6GB Fast ATA-2	4.1GB Fast ATA-2
Graphics adapter	ATI 3D Rage II (integrated)	S3 ViRGE (integrated)	Matrox Millennium	Number Nine Imagine128 Series II	Matrox Millennium	STB Velocity 3D	S3 ViRGE (integrated)*
Memory	2MB SGRAM	2MB EDO DRAM	4MB WRAM	4MB VRAM	4MB WRAM	4MB EDO VRAM	2MB EDO
Monitor	AcerView 77is	ASTVision 7L	Samsung D1728-LS	Samsung D1528-LS	LG Electronics FR-PCXBV-ZW	MAG CrystalScan700	Hewlett-Packard D3859A
Claimed/measured diagonal size (inches)	17, 15.8	17, 15.5	17, 15.8	15, 13.8	17, 16.2	17, 15.9	17, 15.8
Multimedia Features							
CD-ROM drive	Acer 612A	Toshiba XM-5602B	Mitsumi FX 120T	NEC CDR-1400A	Toshiba XM-5602B	Mitsumi CRM-CFX120T	GoldStar CRD-B160B
Speed and interface	12X ATAPI	8X ATAPI	12X ATAPI	8X ATAPI	8X ATAPI	12X ATAPI	16X ATAPI
Sound adapter	GVC MD-2781	Silicom ADBT 3D Sound	Creative Labs Sound Blaster AWE32 Upgrade Card	Creative Labs Sound Blaster 16 Value	Creative Labs Sound Blaster 16 IDE	Ensoniq SoundscapeVIVO	Yamaha OPL3-SA
Speakers	Aura (integrated in monitor)	Labtec LCS-1020	Altec Lansing ACS490	Altec Lansing ACS31	Goldmedia 3DS-12	Altec Lansing ACS-410	Altec Lansing
Modem speed (data/fax, in Kbps)	33.6/14.4	33.6/14.4	33.6/14.4	N/A	N/A	33.6/14.4	33.6/14.4
Motherboard Components							
Installed external RAM cache and type	256K pipelined-burst	256K pipelined-burst	512K pipelined-burst	256K pipelined-burst	512K pipelined-burst	512K pipelined-burst	256K pipelined-burst
Motherboard manufacturer	Acer	Intel	Intel	Dell	Digital	Intel	Intel
Chip set	ALI M1521	Intel 82430HX	Intel 82430VX	Intel 82430FX	SiS 85C511	Intel 82430VX	Intel 82430HX
BIOS manufacturer and version (or date)	Acer (8/96)	AST 905588 1.00.05.DLOQ	AMI/Dell X13	Phoenix/Dell 1.10 A00	Phoenix (1/1/96)	AMI 0.00.06DQ0T Alpha 6.01.02	AMI 1.00.01.DLO1
Expandability							
Expansion-bus slots	3 ISA, 2 PCI, 1 PCI/ISA	4 ISA, 1 PCI, 1 PCI/ISA	2 ISA, 3 PCI, 1 ISA/PCI	1 ISA, 1 PCI, 1 PCI/ISA	2 PCI/ISA	2 ISA, 3 PCI, 1 PCI/ISA	4 ISA, 2 PCI
Front-accessible drive bays (5.25", 3.5")	2, 1	3, 1	2, 3	1, 1	2, 1	3, 1	2, 2
Internal drive bays (5.25", 3.5")	1, 1	0, 3	0, 2	0, 1	0, 1	0, 3	1, 2
Power-supply wattage	147W	200W	200W	145W	100W	145W	160W
Parallel/serial/mouse ports	1, 2, 1	1, 1, 1	1, 1, 1	1, 2, 1	1, 2, 1	1, 1, 1	1, 1, 1
Service and Support							
24-hour, 7-day live technical support	■	■	■	■	■	■	■
Standard warranty on parts/labor	1 year/1 year	1 year/1 year	3 years/1 year	3 years/1 year	3 years/1 year	3 years/3 years	1 year/1 year
On-site service included	90 days	1 year	1 year	1 year	1 year	1 year	1 year
24-hour turnaround for replacement parts	■	■	■	■	■	■	■

N/A—Not applicable: The product does not have this feature * This product also has a 3Dfx Interactive Voodoo 3-D daughtercard

shop Gaussian Blur test. All other scores were average.

Both Dell PCs are good choices for their intended users. These models show why two other similarly equipped Dell systems recently won Editors' Choice awards ("Pentium and Pentium Pro: Choose Your 200," December 3, 1996). —Robert S. Anthony

Dimension XPS M200s. Direct price: \$3,179. **OptiPlex Gs 200.** Direct price: \$3,265. Dell Computer Corp., Austin, TX; 800-388-8542, 512-338-4400; fax, 512-728-3653; www.dell.com. *Circle 477 on reader service card.*

Digital Equipment Corp.

Celebris FX 5200M

The Celebris FX 5200M (\$4,060 street), from Digital Equipment Corp., is a network-ready, easy-to-service Pentium MMX machine for the mainstream commercial user who wants top-notch performance. (With an upgrade to 64MB of RAM, the price is \$4,380.) The Celebris was a competitive performer on our benchmark and applications tests, a fact that is welcome in view of the comparatively high price. Digital's Celebris and Venturis PC lines will continue to in-

clude standard Pentiums for users seeking good value and decent performance.

The Celebris came outfitted with EDO



Office PC: Celebris FX 5200M.

PC MAGAZINE
EDITORS' CHOICE

IBM PC 350	Micron Millennia MXE P200	NEC PowerMate P2000M	Packard Bell Platinum 2240	Quantex OP5/200 SM-3
\$4,581 (list)	\$2,848 (direct)	\$3,860 (street)	\$2,700 (street)	\$3,399 (direct)
Business	Business	Business	Home	Business
32MB EDO	32MB EDO	32MB EDO	32MB EDO	32MB SDRAM
IBM DAQA-32700	Western Digital Caviar AC33100	IBM DAQA-33240	Quantum Fireball TM3200A	Seagate Barracuda ST34371W
2.5GB EIDE	2GB EIDE	3GB ATA-3	3GB Fast ATA-2	4GB Ultra SCSI
Matrox Millennium	Diamond Stealth 3D 2000	ATI Pro Turbo Rage-5T	S3 ViRGE (integrated)	Matrox Millennium
4MB WRAM	4MB EDO	4MB SGRAM	2MB EDO	4MB WRAM
IBM 670	Micron LM-1764	NEC MultiSync 17XV17+	Packard Bell 3030	MAG InnoVision DX700T
17, 15.5	17, 15.9	17, 15.6	17, 15.8	17, 16
Hitachi CDR-7930	Hitachi CDR-8130	NEC MultiSpin BV	NEC 1400C	Toshiba XM-5702B/T
8X ATAPI	12X ATAPI	8X ATAPI	8X ATAPI	12X ATAPI
Creative Labs Sound Blaster AWE32 PnP	Creative Labs Sound Blaster AWE32 PnP	Creative Labs Vibra 16C	Aztech Labs Sound III 336FSP	Ensoniq SoundscapeVIVO90
Cambridge SoundWorks SWK1	Advent AV270	NEC	Packard Bell BBE	Altec Lansing ACS400
N/A	N/A	N/A	33.6/14.4	33.6/14.4
512K pipelined-burst IBM	512K pipelined-burst Micronics	512K pipelined-burst Intel	256K pipelined-burst Packard Bell/Intel	512K pipelined-burst Netrix
Intel 82430HX	Intel 82430HX	Intel 82430HX	Intel 82430VX	Intel 82430VX
IBM (9/26/96)	Phoenix 4.05 M55Hi-Plus 04.1	AMI 0.02.03.DKO	AMI 1.00.08DNOR	AMI TVX0917D
1 ISA, 3 PCI/ISA	3 ISA, 3 PCI, 1 PCI/ISA	2 ISA, 2 PCI, 1 PCI/ISA	1 ISA, 2 PCI, 1 PCI/ISA	3 ISA, 2 PCI, 1 PCI/ISA
2, 1	2, 3	3, 1	3, 1	4, 1
0, 2	0, 2	0, 2	0, 1	0, 3
200W	250W	200W	204W	200W
1, 1, 1	1, 2, 1	1, 2, 1	1, 1, 1	1, 2, 1
3 years/3 years 1 year	3 years/1 year 1 year	3 years/3 years 1 year	1 year/1 year 1 year	3 years/1 year 1 year

DRAM and 512K of L2 cache. A 2GB Fast ATA-2 hard disk (the Quantum Fireball) and a Matrox Millennium graphics card with 4MB of WRAM drive the disk and graphics subsystems. The system was an average performer on all benchmark tests except CD-ROM WinMark 97, on which it turned in an above-average score. Its PhotoDeluxe Soften Image and Unsharpen Mask times were slower than the average, but the other applications test scores were average except for an above-average Photoshop Gaussian Blur result.

The DMI-compliant Celebris also features a MIF browser, integrated 10Base-T

Ethernet support (upgradable to 100Base-T), a 17-inch Digital-branded LG Electronics monitor, and an 8X Toshiba CD-ROM drive. A sound card from Creative Labs (the Sound Blaster 16) and Goldmedia speakers make up the audio subsystem.

If you're willing to pay the price, the Celebris FX 5200M represents a good choice for corporate installations.—*Mary E. Behr*

Celebris FX 5200M. Street price: \$4,060. Digital Equipment Corp., Acton, MA; 800-344-4825; faxback, 800-367-0436; www.windows.digital.com. *Circle 478 on reader service card.*

Gateway 2000 Inc.

Gateway P55C-200 FPC



Gateway 2000 is betting that the MMX Pentium's big bang-for-the-buck ratio will appeal to families on a budget. After testing the Gateway P55C-200 FPC (\$2,918 direct price), we'd say that the company wins the bet. In fact, the P55C-200's high-flying performance and great features impressed us so much that we gave it our Editors' Choice award in the home PC category.

Using components such as 512K of pipelined-burst L2 cache, 32MB of synchronous DRAM, and a 3.6GB Quantum hard disk, the P55C-200 led the home PC pack on most of our tests. Its most stunning result was on our Graphics WinMark 97 test suite: Powered by an STB Velocity 3D graphics engine, the system posted an astronomical score that put it 51 percent ahead of the nearest home PC competitor. Its Winstone 97 score was also number one among home PCs, and it led the group on our PhotoDeluxe and Kai's Power GOO applications tests.

The system's other peripherals include a 17-inch CrystalScan monitor, a 33.6/14.4-Kbps Telepath fax modem, and a PC ProPad 4 game pad. An Ensoniq Soundscape VIVO sound card and a set of Altec Lansing ACS-410 speakers supply the sound. A huge software bundle includes Microsoft Works and Money and many home-oriented titles.

The Pentium MMX-based Gateway P55C-200 FPC would be a great addition to any home or home office.—*MEB*

Gateway P55C-200 FPC. Direct price: \$2,918. Gateway 2000 Inc., N. Sioux City, SD; 800-846-2000, 605-232-2000; fax, 605-232-2023; www.gw2k.com. *Circle 479 on reader service card.*



Home PC: Gateway P55C-200 FPC.

Hewlett-Packard Co.

HP Pavilion 7370V

The HP Pavilion 7370V (\$3,550 street) is the high-end entry in Hewlett-Packard's Pavilion line of home PCs, and it is designed for gaming, imaging, and other recreational purposes. The Pavilion line also includes the Family Fun, the Imaging Enthusiast, and the Home Theater, most of which HP will be building around Pentium MMX processors.

The Pavilion performed well, posting all average benchmark test scores in the home PC category except for its above-average CD-ROM WinMark score. The system's MMX applications test scores were also average.

Two of the Pavilion's software titles, MechWarrior 2 and Whiplash, work well with its graphics subsystem: an integrated



Home PC: HP Pavilion 7370V.

S3 ViRGE chip set aided by an Orchid Righteous 3D daughterboard with the 3Dfx Interactive Voodoo chip set. The unit also ships with a Logitech game pad, the ThunderPad.

One hardware highlight is HP's new One-Touch Multimedia Keyboard, which has volume, mute, Internet, phone, voice mail, suspend, and CD player controls. Other features include a 16X GoldStar CD-ROM drive, a 17-inch HP monitor, integrated Yamaha sound, two Altec Lansing speakers, a subwoofer, and a Digitan 33.6/14.4-Kbps DSVD modem with full-duplex speakerphone and voice mail.

The HP Pavilion 7370V is the quintessential MMX system, designed specifically for high-power gamers and other entertainment users.—*CM*

HP Pavilion 7370V. Street price: \$3,550. Hewlett-Packard Co., Cupertino, CA; 800-724-6631, 810-357-1219; fax, 810-357-1317; www.hp.com/info/pchome1. Circle 480 on reader service card.

IBM PC Co.

IBM PC 350

The IBM PC 350 provides a high degree of manageability, a clean design, and competitive performance. But it's also the most expensive PC in this roundup, list-priced at \$4,581 (\$5,037 with 64MB of RAM). The PC 350 is part of IBM's high-performance corporate line. Also available are the Aptiva line of home PCs (which will incorporate the MMX Pentium early this year) and the 700 series of corporate PCs.

A modular internal design allows easy access to key components. The motherboard has two USB ports and a connector for an external infrared device. The unit came with a 2.5GB IBM hard disk, a Matrox Millennium graphics board, an 8X Hitachi CD-ROM drive, a 17-inch IBM G70 monitor, a Creative Labs Sound Blaster AWE32 sound card, and a set of Cambridge SoundWorks speakers with a subwoofer.

The PC 350 logged average scores on our Business Winstone 97 and Business Disk WinMark 97 tests but was slightly behind most of the pack on our Business Graphics WinMark 97 tests. Its CD-ROM WinMark 97 score was by far lowest here. On our applications tests, the PC 350 mostly kept pace with its peers.

IBM includes some network-oriented software: Intel ProShare data-collaboration software and a set of IBM utilities, including NetFinity for managing connected clients over a network. Despite its high price, the PC 350 has much to offer.—*RSA*
IBM PC 350. List price: \$4,581. IBM PC Co., Armonk, NY; 800-426-4968; faxback, 800-426-4329; www.pc.ibm.com. Circle 481 on reader service card.



Office PC: IBM PC 350.

Micron Electronics Inc.

Millennia MXE P200



With a mix of proven technology and top-notch components, the Millennia MXE P200 (\$2,848 direct, or \$3,148 with 64MB of RAM) is yet another feather in the cap of Micron Electronics, not to mention another Editors' Choice recipient. This PC, following in the footsteps of previous Millennias, posted some of the best test scores in this roundup. The unit's chart-topping graphics performance and hardware bundle make it a great choice for its target audience of home and small-business users who place high demands on graphics performance.

The midtower Millennia MXE P200 features a 2GB Western Digital hard disk,



Office PC: Millennia MXE P200.

a 12X Hitachi CD-ROM drive, a Creative Labs 16-bit FM-synthesis sound card, and a Diamond Stealth 3D 2000 graphics board with 4MB of EDO DRAM and an S3 ViRGE chip set. By the time you read this, a 2.5GB hard disk and an Iomega Zip drive will be standard.

The Millennia MXE was a great performer on our tests. It posted the best CD-ROM WinMark 97 and Photoshop Gaussian Blur and Unsharp Mask test scores in this roundup, as well as the best Graphics WinMark 97 score of all business PCs tested. The unit has a 17-inch Micron monitor, two Advent bookshelf speakers, and a small bundle of MMX-enabled software, including Adobe PhotoDeluxe. If a powerful PC is what you're after, Micron's Millennia MXE delivers.—*RSA*

Millennia MXE P200. Direct price: \$2,848. Micron Electronics Inc., Nampa, ID; 800-388-6334, 208-893-3434; fax, 208-893-3424; www.mei.micron.com. Circle 482 on reader service card.

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64MB of ECC 4 way Interleaved Memory to 1GB	1 Intel Pentium Pro 200MHz Processor, Upgradable to 2 CPUs	256K Cache	Triton II Chipset	1 DEC 500MHz Alpha CPU
Slots (6) PCI; (4) EISA	32MB of 60 ns RAM Expandable to 512MB, ECC Supported	Slots: (5) PCI; (4) ISA	512K Cache	64MB RAM to 1GB
Adaptec 3940 UW	Imagine 128 Series II 128 Bit	64MB (60ns) EDO, Expandable to 512MB, ECC Supported	32MB RAM Expandable to 256MB	Slots (4) PCI, (2) ISA
9.1GB 7200 RPM Ultra Wide Hard Drive	4 MB VRAM	4,408 7200 RPM UW HD	Slots: (4) PCI; (4)EISA	Adaptec 2940 Ultra Wide SCSI Controller
Bx CD-ROM	Integrated on Board: • Adaptec 2940 Ultra Wide Controller	Adaptec 2940 Ultra Wide Controller	Sony 16x CD-ROM	Sony Bx CD-ROM
Matrox 6MB VRAM Video, PCI	• 16-Bit Sound Card	16x 1GB Removable HD	Floppy, Keyboard, Mouse	
Sony 24GB DAT Drive	• Intel 10/100 PCI Ethernet	Glyte Max 8MB PCI Video	Imagine 128 Series II 128 Bit "3D"	Imagine 128 Series II 8MB VRAM "3D" Video
Cognet PCI Ethernet 10/100	Open Slots: (3) PCI, (1) ISA	MS Workstation 4.0	4MB DRAM Video	9.1GB 7200 RPM Ultra Wide Hard Drive
Floppy, Keyboard and Mouse	4.408 7200 RPM UW HD	Sony 16x CD-ROM	3.2GB HD (9.5ms)	Keyboard, Floppy, Mouse
12 Bay Tower 450 Watt Power	Sony Bx CD-ROM	Keyboard, Floppy, Mouse	32 Pin Sound	Tower 300 Watt Power
	Tower Case, 300 Watt	Tower Case, 300 Watt	Tower Case	
	\$3450	Hitachi UX4721 21" Monitor, 22	MAG 700T, 17" Monitor .25	\$613
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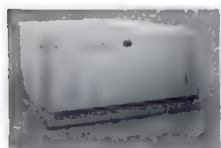


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SAG STF 150 Pentium

NEC Computer Systems Division

PowerMate P2200M

The PowerMate P2200M, street-priced at \$3,860 (\$4,170 with 64MB of RAM), is a fairly good performer, offering networking features corporate buyers will like. The PowerMate line is the first of NEC's lines to adopt MMX. Others will follow: The Ready line of home PCs will soon offer MMX; the PowerPlayer gaming line and the Ready Office PC line for the office/home office will incorporate MMX in a few months. All MMX PCs will offer higher-end surrounding hardware and will ship with MMX software titles.

The Intel motherboard integrates 16-bit Creative Labs sound, which operates in tandem with two NEC speakers. With 512K of pipelined-burst L2 cache, a 3GB



Office PC: PowerMate P2200M.

5,400-rpm IBM hard disk, and an ATI Pro Turbo 3D Rage-GT graphics card with 4MB of SGRAM (2MB is standard, and the included option is \$75 extra), the system posted mostly average test scores. The exceptions were its below-average Graphics WinMark 97 and CD-ROM WinMark 97 scores. The culprit in the latter case was the unit's 8X CD-ROM drive, one of the few 8X models here (a variable-speed 12X/16X drive will be standard by the time you read this).

On most of our MMX applications tests, the PowerMate stacked up well compared with its peers. But it posted subpar scores on two of our Photoshop tests.

The unit also offers an Iomega Zip drive, an infrared port, two USB ports, DMI support, and Intel's LANDesk Client Manager. The PowerMate is no doubt appropriate for the corporate space.—*CM*
PowerMate P2200M. Street price: \$3,860. NEC Computer Systems Division, Mountain View, CA; 800-306-4636, 508-264-4300; faxback, 800-366-0476; www.nec.com. *Circle 483 on reader service card.*

Packard Bell NEC

Packard Bell Platinum 2240

In addition to three MMX applications, the Packard Bell Platinum 2240 (\$2,700 street) offers home users 3-D graphics, a big software bundle, and an add-on module for external access to telephony and multimedia features.

The Platinum's mini-tower chassis features a Packard Bell motherboard and 256K of L2 cache. With these components and a 3GB hard disk, the unit delivered mostly average test scores. Its Disk WinMark 97 score was above the average, however. On our MMX tests, the unit posted average scores, except for its below-average marks on the Unsharpen Mask test under PhotoDeluxe.

The Platinum's price includes a 33.6/14.4-Kbps modem, a 17-inch Packard Bell monitor, a pair of Packard Bell speakers that attach to the monitor, and a piece of hardware known as the MediaSelect. This thin plastic piece plugs into the system's mouse port (the mouse connects to it) and attaches to the front of the PC under the monitor. It has two LCDs that indicate fax arrivals and phone messages, as well as buttons that let you activate the CD-ROM drive, among other features. The unit also provides a Brooktree video-capture chip set that connects to an S-Video/composite video port (which can be used with standard camcorders and VCRs).

Bundled software includes VocalTec Internet Phone and three additional MMX-enabled titles.

For the money, the Platinum is a very attractive MMX PC.—*CM*

Packard Bell Platinum 2240. Street price: \$2,700. Packard Bell NEC, Sacramento, CA; 800-733-5858; fax, 801-579-0093; www.packardbell.com. *Circle 484 on reader service card.*



Home PC: Packard Bell Platinum 2240.

Quantex Microsystems

Quantex QP5/200 SM-3

The Pentium MMX CPU is a natural fit with the Quantex QP5/200 SM-3 (\$3,399 direct, or \$3,649 with 64MB of RAM)—a PC that represents the high end of the company's Multimedia PC line. The P55C dovetails well with the system's adept sound and graphics subsystems, as well as with its target market: home- and small-office users.

The mini-tower has a remarkably neat and spacious interior. A Netrix motherboard supports synchronous DRAM, has 512K of L2 cache, and offers an unexpected perk: an Adaptec AHA2940UW ultra-wide SCSI adapter.

A 4GB, 7,200-rpm Seagate Ultra SCSI hard disk and Matrox Millennium graphics



Office PC: Quantex QP5/200 SM-3.

card led to an average Winstone 97 score, while a 12X Toshiba CD-ROM drive yielded an above-average CD-ROM WinMark score. The unit earned some of the best PhotoDeluxe test scores but was below the average on our Photoshop Unsharpen Mask test. All other scores were average.

The unit provided great sound thanks to an Ensoniq wavetable card and a set of Altec Lansing ACS400 speakers with an ACS250 subwoofer. The machine also includes a MAG 17-inch monitor and a 33.6/14.4-Kbps modem with voice mail and full-duplex speakerphone support. Quantex also bundles Corel Print House, Corel WordPerfect Suite 7, and Quicken SE.

The QP5/200 SM-3 surrounds the MMX Pentium as it should be surrounded: with a fine audio subsystem, a high-end graphics card, and a brisk CD-ROM drive.—*CM* □

Quantex QP5/200 SM-3. Direct price: \$3,399. Quantex Microsystems, Somerset, NJ; 800-760-9001, 908-563-4166; fax, 908-563-0407; www.quantex.com. *Circle 485 on reader service card.*

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EIZO NANAO WINS AGAIN!

Back To Back Nod For Monitor Maker

By Rex O. Looshun
MONITOR STAFF WRITER

LOS ANGELES — It's an announcement that is becoming all too familiar. EIZO Nanao Technologies has once again taken home the coveted Editor's Choice Award from PC Magazine.

This sixth award in the past six years goes to the company's FlexScan® TX-C7S 17-inch class color monitor. It's an honor that carries particular significance as it cites superiority in the judging category having the toughest standards.

"The TX-C7S monitor's image was especially sharp and clear, with no detachable faults," said a PC Magazine judge.

Not too surprising for EIZO, though. The company's monitors previously earned Editor's Choice



**October 8, 1996
FlexScan TX-C7S**

accolades in 1990, 1992, 1993—for its FlexScan 9400, F550iW and FlexScan F340iW monitors—and last year for its highly regarded FlexScan T2-17TS model.

TX-C7S Lauded as 'Best of the Best'

By E.Z. Viewlin
MONITOR STAFF WRITER

LOS ANGELES—Words such as "unbeatable," and "top flight," have been flying around town ever since EIZO Nanao's FlexScan TX-C7S 17-inch class color monitor walked off with the 1996 PC Magazine Editor's Choice Award.

With this key award under its belt, the FlexScan TX-C7S figures to be the monitor of choice for graphics and business professionals who demand crisp, true-to-life colors and stable screen images



This year's big winner: The FlexScan TX-C7S 17-inch class color monitor.

for desktop publishing, 24-bit imagery, high-end graphics and multimedia applications.

Editor's Choice: The Award That Shapes Industry Thinking



It's deja vu all over again: EIZO Nanao has now won six Editor's Choice Awards in six years.

By Mona Turr
MONITOR STAFF WRITER

LOS ANGELES—Winning a PC Magazine Editor's Choice Award tells the world of hungry hardware buyers that you've arrived in a big way.

"It's the one award we all dream about, the one we covet more than any other," said N.V.S. Guy of Silicon Valley's LuzerCom.

EIZO Nanao monitors have earned worldwide recognition for dependability, cost-effective performance and pleasing, ergonomic design. In fact, I'm going to stop writing this story right now so I can call EIZO Nanao Technologies at **1-800-800-5202**. Then again, I could get an informational fax on demand by calling **1-800-416-FLEX**. Either way, like the TX-C7S, I'm a winner.



EIZO is Nanao's New Universal Brand Name
EIZO Nanao Technologies Inc., 5710 Wartland Dr., Cypress, CA
90630 Web Site: <http://www.eizo.co.jp/welcome>

Digital Dragsters

Just as CDs supplanted vinyl records, digital devices will eventually replace analog modems. A PC speaks digitally, and most of the data communications network does as well, so why have a slow analog middleman? You don't have to wait anymore: High-speed ISDN access is available today across most of the country. ISDN (Integrated Services Digital Network) has finally come into its own, fueled by an increasing demand for greater bandwidth.

Basic ISDN service provides two *B-channels*, which can each carry 64 Kbps of data or a voice call. The two B-channels can be combined to provide a single 128-Kbps channel—or close to four times the bandwidth of an analog 33.6-Kbps modem.

ISDN has other advantages besides raw speed. Call setup times are typically less than half a second (though authentication and compression negotiation can take much longer), which compares with 30 seconds or more for modems. And ISDN is an all-



Think fast: One of these 18 ISDN adapters can give your PC the zippy bandwidth you need to connect to the outside world—today.

By Les Freed

ISDN Across America

ISDN pricing and availability vary greatly by region. Though it can be difficult to order, several vendors in our review offer consumers assistance in getting ISDN service from these regional phone companies.

U.S. West

Coverage: Statistics not available. **Start-up fee:** \$67-\$110. **Extra costs:** Parts and labor. **Monthly fee:** \$60 (basic service option). **Line fees:** \$0.02/minute after the first 200 hours. **Toll-free number:** 800-898-9675. **Web:** www.uswest.com/isdn/ps_isdn_index.html. (No service in New Mexico because of tariff restrictions.)

Ameritech

Coverage: Urban, 90-95%; rural, 80%. **Start-up fee:** Home, \$128-\$150; business, \$145-\$162. **Extra costs:** New residential line, \$34.75; time and material charges. **Monthly fee:** Home, \$29-\$41 (Indiana, \$97); business, \$39-\$43 (Indiana, \$97). **Line fees:** \$0.02-\$0.08/minute/message or call, varies by state. **Toll-free number:** 800-832-6328. **Web:** www.ameritech.com/products/data/isdn.

NYNEX

Coverage: Statistics not available. **Start-up fee:** Home, \$93-\$125 (Massachusetts, \$67; New York, \$234); business, \$106-\$141 (New York, \$325). **Extra costs:** Inside wiring. **Monthly fee:** Home, \$24-\$34 (Vermont, \$60); business, \$36-\$55 (Vermont, \$90). **Line fees:** Home, \$0.01/minute/B-channel; business, \$0.03/minute/B-channel. **Toll-free number:** 800-438-4736. **Web:** www.nynex.com/isdn/isdn.html.

Pacific Bell

Coverage: 97%. **Start-up fee:** \$125. **Extra costs:** New residential line, \$34.75; new business line, \$70.75. **Monthly fee:** Home, \$24.50; business, \$26.05. **Line fees:** Home 8:00-5:00 M-F and business, \$0.03 first minute, \$0.01 each additional minute; home off-peak, flat rate per B-channel. **Toll-free number:** 800-472-4736 (Northern Nevada, call 702-333-4939 to order Centrex; southern Nevada, call the local phone company.) **Web:** www.pacbell.com.

Southern New England Telephone

Coverage: 100%. **Start-up fee:** \$265. **Extra costs:** \$15 per additional number; RJ-45, \$28.39. **Monthly fee:** \$50, plus \$7.50 per additional number. **Line fees:** 8:00-5:00 M-F, \$0.035/minute; off-peak, \$0.015/minute. **Toll-free number:** 800-430-4736. **Web:** www.snet.com.

Bell Atlantic

Coverage: 90-100%. **Start-up fee:** Home, \$125; business, \$100-\$141 (Pennsylvania, \$170). **Extra costs:** Inside wiring. **Monthly fee:** Home, varies (example: 60 hours/month, \$35-\$45); business, \$31-\$50. **Line fees:** Home: 7:00-7:00 M-F, \$0.02/minute/B-channel, off-peak, \$0.01/minute/B-channel; Business: \$0.02/minute/B-channel. **Toll-free number:** 800-858-9413. **Web:** ba.com/isdn.html.

Bell South

Coverage: 82%. **Start-up fee:** Home, \$195-\$225 (Tennessee, \$3); business, \$228-\$256 (North Carolina, \$212; Tennessee, \$6). Includes: EUCI, SLC, line installation. **Extra costs:** Tax, extra jacks and wiring. **Monthly fee:** Home, \$56-\$78 (Tennessee, \$33); business, \$103-\$112. **Line fees:** \$0.01/minute/B-channel. **Toll-free number:** 800-858-9413. **Web:** www.bellsouth.com/isdn.

Southwestern Bell

Coverage: Urban, 90-95%; rural, statistics not available. **Start-up fee:** \$425.25. **Extra costs:** EUCI charge per B-channel, \$6. **Monthly fee:** \$45.50. **Line fees:** \$0.04/minute/B-channel after the first 10 hours. **Extra costs:** Packet data. **Toll-free number:** 800-792-4736. **Web:** www.sbc.com.

GTE

Coverage: 60% (of states in coverage area). **Start-up fee:** \$80-\$100. **Extra costs:** Loop extension, \$20-\$25. **Monthly fee:** \$30-\$50. **Line fees:** \$0.02-\$0.03 per minute. **Toll-free number:** 800-483-4926. **Web:** www.gte.com/isdn.

digital service; unlike modems, which must negotiate a connection speed based on the quality of the connection, ISDN provides a clear, 64-Kbps or 128-Kbps connection every time. Though ISDN service is more expensive than regular phone service (see the sidebar "When Is ISDN

Worth It?"), you might find its benefits compelling.

REVIEW CRITERIA

When we last reviewed ISDN adapters ("Fast Connections," June 11, 1996), 6 products met our review criteria. This

time around, 15 products from 11 vendors passed through our filter, and they are better, faster, and less expensive.

We reviewed a mix of six internal and nine external units, as well as three PC Card ISDN adapters (see the sidebar "ISDN For Your Laptop" for a look at these products). We required that the products work with Microsoft Windows 95 and the Multilink PPP (MP) protocol, the de facto standard for combining the two B-channels into one 128-Kbps connection. Each also needed to include an ISDN U interface (an integrated NT-1 device), which allows the adapter to connect directly to the ISDN line. We looked at ISDN adapters, which are designed for a single user's desk-

IN THIS REVIEW

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Connectware PhoneWorks ISDN Ext.....	154	U.S. Robotics DataBurst ISDN 128K.....	166
Diamond Supra NetCommander ISDN.....	156	U.S. Robotics Sportster ISDN 128K.....	166
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ISDN*tek CyberSpace Internet+Plus Card.....	160	ZyXEL Omni TA128.....	168

Editors' Choice

- External: 3ComImpact IQ External ISDN Modem
- Internal: Supra NetCommander ISDN



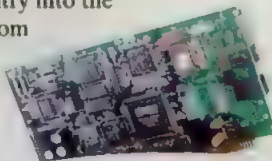
Any of the ISDN adapters here can give you the basic hot wheels for high-speed digital connections. But the 3ComImpact IQ External ISDN Modem and Diamond's Supra NetCommander ISDN stand out for their exceptional ease of use, excellent features, and

good performance test results.

Our Editors' Choice among external adapters, the 3ComImpact IQ External ISDN Modem (\$499 list), is designed inside and out to provide an easy entry into the world of ISDN. It succeeds with a flourish. 3Com

Corp. is one of the few vendors here (along with Diamond Multimedia Systems, Motorola Information Systems Group, and U.S. Robotics) that will help you provision an ISDN line from your phone company—often the hardest part of setting up an ISDN adapter.

The 3ComImpact's installation software automatically detects your ISDN switch type and SPIDs. Of the products here, only the Adtran Express XRT has a similar feature. Round-



ing out 3ComImpact's features are two top-quality analog phone connections, eight LEDs that display status info, and a full suite of software. During testing, the 3ComImpact showed good throughput.

Diamond Multimedia Systems' Supra NetCommander ISDN, our Editors' Choice among internal adapters, also impressed us with its ease of installation and showed excellent test performance. List priced at \$249, the NetCommander offers more features than pricier adapters: The Plug and Play card includes great diagnostic and monitoring software, as well as a single port to connect up to three analog devices. Also, like 3Com, Diamond offers a free service to help you provision an ISDN line.

top, as opposed to ISDN routers, which have a network connection and are designed to provide access to multiple users.

A few new products weren't ready in time for review or didn't meet our criteria, including Ascend's NetWarp, Boca Research's Webglider, Eicon's internal DIVA Pro 2.0, and Hayes's Accura ISDN. We also didn't test Farallon's Netopia ISDN Modem, a version of 3Com's product.

WHAT WE FOUND

During last year's testing, many of the ISDN vendors did not provide drivers to work with Windows 95 Dial-Up Networking, so we tested those products with a third-party protocol stack. This time around, all of the products came with drivers for Windows 95. As a result, most of the products were capable of using the data compression built into Windows 95 Dial-Up Networking, which includes compression licensed from Stac (now known as Hi/fn). Because the compression is software-based, data is compressed before it's

sent to the adapter, so the external adapters weren't bottlenecked by the PC's 115.2-Kbps maximum serial-port speed. Also, for internal adapters, Microsoft released the ISDN Accelerator Pack 1.1 for Windows 95, which added support for Multilink PPP.

Each internal adapter here was compatible with the Accelerator Pack 1.1, except the U.S. Robotics Sportster and DataBurst products, which at review time used Version 1.0 of the Accelerator Pack. Also, the Cardinal IDC100i could not make dual-channel calls using the Accelerator Pack.

The products here vary widely in the way they provide support for analog devices. Most provide one or two RJ-11 jacks, which allow you to use any analog device—phone, fax machine, or modem—on your ISDN line. Five products don't provide support for analog devices at all. If you plan to replace your existing plain old telephone service line with ISDN, you'll want an ISDN adapter that provides ring voltage to attached devices.

ISDN has a well-deserved reputation

for being difficult to set up. You can't just plug an ISDN adapter into the phone line; it must be configured to work with your specific phone line. Several products, though, were easy to install. In fact, the Adtran Express XRT and 3ComImpact IQ External ISDN Modem automatically configure themselves; you tell the adapter the phone number for the ISDN line, and it figures out the switch type and SPIDs (Service Profile Identifier). We expect other vendors will soon provide this helpful feature.

PUTTING ISDN TO WORK

Setting up an ISDN adapter may be difficult, but provisioning an ISDN line from your local phone company can be an exercise in utter frustration. There are dozens of configuration options on an ISDN line, and if one of them is wrong, your line may not work with your equipment. Most of these ISDN adapters come with ISDN line-ordering instructions in the box or forms to fax to the phone company. Vendors and phone companies are working to make the process simpler through ISDN Ordering Codes (IOC) and EZ-ISDN, which specify sets of voice and data service parameters.

Alternatively, a few of the vendors here—Diamond Multimedia Systems, Mo-

Our Contributors: LES FREED and TONY POMPILI are contributing editors of *PC Magazine*. ANDREW GO is a support technician at PC Magazine Labs. JOHN GARIS is a frequent contributor to *PC Magazine*. TODD SPANGLER was the associate editor in charge of this story, and JEFFREY G. WITT was the project leader.



How fast is Sportster ISDN?

"The U.S. Robotics Sportster ISDN 128K stood out for its performance, ease of use, all-around flexibility, and reasonable price... it blew away the competition in our remote access tests, making it an ideal choice for telecommuters. The Sportster was a dream to install—you simply plug it in and go." PC World, August '96

"The Sportster ISDN 128K might have been named the Screamer. It was the only product in our test group to provide data compression, and this ISA-bus ISDN adapter, from U.S. Robotics, blew the other five products away on our performance tests." PC Magazine, June '96

"A top performer in our testing, the inexpensive, feature-rich Sportster 128K has 'buy me' written all over it... At only \$399, this internal adapter rockets you from place to place on the Internet at speeds of over 113 Kbps with none of the limitations imposed by a serial port." CNET, July '96

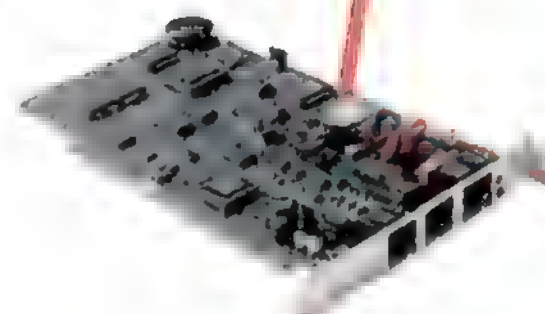
Let's just say light is starting to get jealous.

It's not surprising, considering the Sportster's features: TurboPPP™ provides compression up to 512 Kbps. The onboard analog port lets you connect a standard phone or fax, allowing you to talk or send/receive a fax simultaneously with data transmission.

Plus, *PC Magazine* felt that "the Sportster was one of the easiest products to install and configure." And we back it up with toll-free support from our I-Team.

It all adds up to the fastest, easiest way to get around online short of a T-1 line. If you'd like to learn more, visit us at www.usr.com or call 1-800 DIAL USR.

The Sportster ISDN 128K. A sure-fire way to make the speed of light green with envy.



"The Screamer"
- *PC Magazine*

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Internet and Online Services: Nationwide ISDN Access

Company	Service	U.S. ISDN access points	Start-up fee	Basic monthly pricing	Telephone	Web site
CompuServe Inc.	CompuServe Information Service	12	None	5 hours, \$9.95; each additional hour, \$2.95 ¹	800-524-3388	www.compuserve.com
	SpryNet	12	None	Unlimited access, \$19.95 ¹	800-777-9638	www.sprynet.com
EarthLink Network Inc.	EarthLink Network	18	\$50	30 hours, \$45.00; each additional hour, \$2.50 ²	888-356-4736	www.earthlink.net
GTE Corp.	GTE Internet Solutions	292	\$40	Unlimited access, \$39.95 ²	800-927-3000	www.gte.net
Microsoft Corp.	The Microsoft Network	301	None	Unlimited access, \$49.95 ²	800-373-3676	www.msn.com
MindSpring Enterprises Inc.	MindSpring	179	\$70	20 hours, \$14.95; each additional hour, \$1.00 ²	800-719-4332	www.mindspring.com
Netcom On-Line Communications Services Inc.	Netcom	14	\$50	30 hours, \$29.95; each additional hour, \$3.00	800-638-2661	www.netcom.com

(1) This service supports a maximum connection speed of 57.6 Kbps. (2) This service adds a surcharge for access to two B-channels.

torola Information Systems Group, 3Com, and U.S. Robotics—provide free ISDN line-ordering services. When you call the vendor, it will call your local phone company and order the ISDN line for you, as well as setting up an account with an Internet service provider who offers ISDN access. 3Com even offers a money-back guarantee if getting its product working with a line it ordered for you takes more than 15 minutes. Microsoft also has jumped on the ISDN bandwagon with a similar ISDN line-ordering service through its “Get ISDN” Web page at www.microsoft.com/windows/getisdn, and The Microsoft Network offers widespread ISDN availability.

If you plan to sign up with an ISDN-capable Internet service provider (see the chart above), you’ll want to see if it offers dual B-channel service. Most ISPs charge

double rates for dual B-channel service, so a single B-channel link might be better. As far as compression goes, you’ll want an ISDN adapter with compression that’s compatible with your ISP’s equipment.

OTHER VOICES ON THE LINE?

Some say ISDN offers too small an improvement over analog modems, and other technologies—like cable modems, DSLs (digital subscriber lines), and a new 56-Kbps modem standard—make it all but obsolete. Another option, Hughes Network Systems’ DirecPC, which the vendor claims offers 400-Kbps downloads, is available today but can be more costly than ISDN.

In fact, 56-Kbps modems may provide ISDN with some competition—when they arrive. The new crop promises close to single-channel ISDN speeds over conven-

tional phone lines. But at this point—with competing technologies from Lucent Technologies, Rockwell, and U.S. Robotics—there are no industry-wide standards for 56-Kbps modems. Also, until the major ISPs, online services, and router manufacturers adopt an industry-standard, 56-Kbps technology, we advise taking a wait-and-see stance.

Cable modem and DSL technologies have received much attention in recent months. Both promise multimegabit speeds and show plenty of promise. Cable modem service is just beginning and DSL trials are underway in a few markets, and several local phone companies are promising DSL service early this year. But given the huge investments required to deploy these services, we think it will be several years before either one is widely available.

ISDN ADAPTERS

How to Read the Suitability to Task Boxes

ISDN adapters intended for small- and home-office desktops must be easy to set up and use for connecting to multiple services.

Moreover, they must have the features and options that desktop users need to take advantage of an ISDN connection.

For **installation and configuration** we give higher ratings to products that offer informative software wizards with step-by-step instructions. We look for adapters that automatically sense switch type and SPIDs. If the adapter requires AT commands, we

SUITABILITY TO TASK

Product name

Installation and configuration	Excellent
Connectivity	Good

expect it to include default AT command strings to prepare the device instantly during setup; if it doesn’t, it should include well-documented examples. The adapters must include clear instructions for establishing single and dual B-channel configurations and dialing. We also want useful diagnostics that give direct feedback for troubleshooting. We prefer that vendors offer complete support packages, services for ordering your ISDN line, and ISP accounts, as well as toll-free help to aid you through the process.

In evaluating **connectivity**, we look at each adapter’s features and ability to access an Internet service provider as well as the corporate network. Products should work seamlessly with the Windows

95 TCP/IP stack. We expect support for Microsoft’s Accelerator Pack 1.1. We like cost-saving measures, such as the ability to use the second B-channel only when needed. We give high marks to products that can connect to a remote-access router using PAP (Password Authentication Protocol) and CHAP (Challenge Handshake Authentication Protocol) authentication and offer call-back security. All adapters should contain compression options that are beneficial, especially when transferring files—a primary task of any telecommuter. We look for POTS (plain old telephone service) port options and consider an adapter’s ability to connect multiple analog devices—telephones, fax machines, or modems—and use them dynamically during ISDN calls.

BE CAREFUL HOW YOU CHOOSE YOUR NEXT PC.



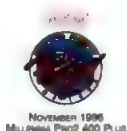
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- Tool-free minitower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows 95 & MS Plus! CD
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- Full-size tower with 10 drive bays
- 15" Micron 15FGx, .28dp (13.7" display)
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- Adapter PCI 32-bit Ultra SCSI Fast-20 controller
- 12X SCSI-2 CD-ROM drive
- 3.5" floppy drive
- 64-bit 1MB ISA video
- 3Com 3C905-TX Fast EtherLink PCI 10/100-base-TX NIC
- Full-size tower with 10 drive bays
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*Second processor requires Microsoft Windows NT Workstation 4.0



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- PCI 64-bit 3D video, MPEG, 4MB EDO RAM
- Tool-free minitower or desktop
- Microsoft Mouse, 104-key keyboard
- Microsoft Windows NT Workstation 4.0 CD
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When Is ISDN Worth It?

By Tony Pompili

ISDN today can deliver high-speed, dial-up access to your desktop computer. Phone companies are starting to promote ISDN service, and ISDN adapters are becoming less expensive. But is ISDN the best route for you?

Determining whether to opt for ISDN depends in part on service availability and cost. Also important is the type of data you're accessing; for file transfers, users will see a dramatic performance advantage with ISDN over analog modems. Internet users will also feel the speedier response of ISDN compared with a 33.6-Kbps modem. And you'll always get a clear 64- or 128-Kbps connection without waiting for modem handshaking, though you may have to wait for authentication and compression negotiation. In the end, you'll want to add up the costs to determine if the expense is worth the performance boost. (See the adjoining chart for a cost comparison of analog versus ISDN.)

But what does an ISDN connection *feel* like compared with an analog modem connection? Based on subjective testing by PC Labs, we found that using a single ISDN B-channel for

Internet access feels even more than twice as fast as using an analog modem connection. In fact, a dedicated 64-Kbps ISDN connection often can deliver much better performance than a congested T1 connection (1.544 Mbps) to the Internet that's shared among several users on a local area network.

All the regional telephone companies now offer ISDN service (see the map "ISDN Across America" in this feature for regional ISDN rates and information), though it may not be available in your area. Ordering an ISDN line is not as straightforward as getting a regular phone line; there are multiple configuration options from which to choose. Of the vendors whose products are reviewed, Diamond Multimedia Systems, Motorola Information Systems Group, 3Com Corp., and U.S. Robotics will help order the ISDN line from your phone company.

You'll want to keep an eye on price.

Certainly, you'll get things done faster with ISDN, and you may instantly get addicted to the extra burst in throughput. But because ISDN service is priced per minute instead of at a flat rate for local calls, you will probably pay more for your ISDN time per kilobyte than you will for analog service (unless you're transferring large amounts of data).

For fast Internet access, one alternative to ISDN to consider is Hughes Network Systems' DirecPC satellite data service (800-347-3272; www.direcpc.com), which the company claims can deliver 400-Kbps downloads. On the downside, DirecPC service requires a direct line of sight to the service's satellite; you must use an analog modem to send information upstream. Moreover, the up-front costs are about twice that of ISDN: a \$750 fee for hardware and startup, not including installation charges. You can, however, get DirecPC in some areas of the U.S. where ISDN service is unavailable.

	ISDN connection	Analog connection
Hardware (street price)	\$200	\$125
Installation fee for home users	\$125-\$250	\$35-\$55
Monthly phone-company fee	\$25-\$50	\$10-\$12
Line usage fee (local call)	1-4 cents per minute	Free-10 cents per call
Internet service per month for unlimited access	\$20-\$40*	\$20

* Some Internet service providers add a per-hour surcharge for using two B-channels

Adtran Inc.

Adtran Express XRT

Unless you work in the telephone or data-communications industries, you may have never heard of Adtran. The company hopes to change that with the Adtran Express XRT ISDN adapter (\$469 list, \$320 street), its first product designed specifically for the consumer market. The Express XRT, which performed well on our throughput tests, is a full-featured external ISDN terminal adapter with two ports for analog devices. A similar model, the Adtran Express XR (\$329 list, \$220 street), is identical to the XRT but lacks analog ports.

SUITABILITY TO TASK

Adtran Express XRT

Installation and configuration	Excellent
Connectivity	Good

The Express XRT is housed in a wedge-shaped plastic cabinet that makes it slightly larger than most analog modems. The unit has five bright status LEDs on the front that indicate the adapter's on/off, B-channel status, and transmit/receive data activity. The rear panel has an ISDN line

jack, a power connector, two analog jacks, an RS-232 port, and a surprise: a unique serial-port pass-through connector that allows you to connect a modem. To do this, you attach the Express XRT to your PC with a serial cable and then connect your modem to the Express XRT. A Windows 95 Taskbar icon allows you to switch between modem and ISDN operation.

Software installation was easy, thanks

to both Windows 95 Plug and Play support and an excellent configuration program. The Express XRT was one of only two products we tested (along with the 3ComImpact IQ External ISDN Modem) that could automatically determine the telephone company switch type and



ISDN for Your Laptop

By John Garriss

A number of PC Card-based ISDN products are now available to get your laptop connected at higher speeds. But don't throw out your analog PC Card modem yet! Although ISDN is now available in most parts of the country, most hotels and offices are still equipped with regular analog phone jacks instead of ISDN lines. Today, laptop users will not yet be able to take ISDN on the road, but if your laptop is your primary machine at home, one of these products may suit you.

We reviewed and tested three PC Card-based ISDN products: the PhoneWorks ISDN+ To Go! (\$619 list price, \$590 street), from Connectware; the DIVA for Windows 95 (PCMCIA) (\$645 list, \$480 street), from Eicon Technology Corp.; and the Extol PCMCIA (\$545 list, \$400 street), from the Racal Data Group. All three work with Windows 95 Dial-Up Networking, include an external NT-1, and can establish a Multilink PPP (MP) connection.

Though we were impressed with the array of features offered by the PhoneWorks ISDN+ To Go!—such as its ability to connect to analog modems—we had difficulty installing it, and it showed relatively poor performance when transferring compressible files (see the performance test results below). For users connecting primarily back to work or to the Internet, the Extol PCMCIA and DIVA PCM both provide solid performance but without the extra features of the PhoneWorks card.

Other PC Card ISDN products include Angia's I-Bahn, Digi Interna-

tional's DataFire GO! PC Card, Fujitsu Microelectronics' ISDN Internet Surfer PC Card, and IBM's WaveRunner. At review time, these were unable to connect with MP; also, the Fujitsu and IBM products did not include an NT-1.

INSTALLATION PROBLEMS

If you're a first-time ISDN user, you'll find installing any of these products confusing. The PhoneWorks was the most difficult to configure; a bug left the configuration software unable to find the card we installed. To Connectware's credit, the bug and a workaround were documented, and Connectware is working on a fix for the problem.

None of the products included adequate information on establishing an MP session. The PhoneWorks didn't include the connect string we needed to use MP; to get it we had to call the company's technical support. The documentation for the DIVA PCM and Extol PCMCIA also made no mention of MP under Windows 95, but for a different reason: Unlike the PhoneWorks, these products rely on Microsoft's Accelerator Pack 1.1 to establish MP connections. For these products, we had to download Accelerator Pack software from each company's Web site.

Because they use the Accelerator Pack to connect, both the DIVA PCM and Extol PCMCIA were able to take advantage of Microsoft's software compression when transmitting data. On our tests, the DIVA had the fastest throughput time, followed closely by the Extol PCMCIA. The PhoneWorks, which implements Multilink PPP using its own method instead of Microsoft's ISDN

Accelerator Pack, did not use any data compression when transferring files, resulting in slower times. For a description of our tests, see the Performance Tests section in this feature.

EXTRA FEATURES

If you plan to call from several locations, you'll appreciate the PhoneWorks' configuration utility, which lets you store multiple configurations and activate the one for your location. With the other products, you must manually change your configuration each time you change location.

Another nice feature was the ability to connect to analog modems at speeds up to 28.8 Kbps, so you don't have to swap out the ISDN card when you want to make an analog call. PhoneWorks also includes a headset to let you make voice calls over your ISDN line.

In the near future, look for more PC Card products on the market that support MP. And as ISDN becomes more widely deployed, PC Card-based products will become an increasingly attractive option for mobile users.

PhoneWorks ISDN+ To Go! List price: \$619. Connectware Inc., Richardson, TX; 800-809-4029, 972-907-1093; www.connectware.com. *Circle 448 on reader service card.*

DIVA for Windows 95 (PCMCIA). List price: \$645 (includes NT-1). Eicon Technology Corp., Montreal, Quebec, Canada; 800-803-4266; www.eicon.com. *Circle 456 on reader service card.*

Extol PCMCIA. List price: \$545. Racal Data Group, Sunrise, FL; 800-722-2555, 954-846-4811; www.racal.com/rdg. *Circle 457 on reader service card.*

Throughput, One B-channel

Noncompressible random file (Kbps) Moderately compressible text file (Kbps)

Bold type denotes first place.

Connectware PhoneWorks ISDN+ To Go!

60.6 61.0

Eicon DIVA for Windows 95 (PCMCIA)

61.0 155.2

Racal Extol PCMCIA

61.0 150.6

Standard 28.8-Kbps modem*

24.8 66.7

BETTER ►

BETTER ►

Throughput, Two B-channels

Noncompressible random file (Kbps) Moderately compressible text file (Kbps)

108.9 85.0

120.5 261.3

120.5 261.2

24.8 66.7

BETTER ►

BETTER ►

* Reported for comparison.



Who won the first Oscar?



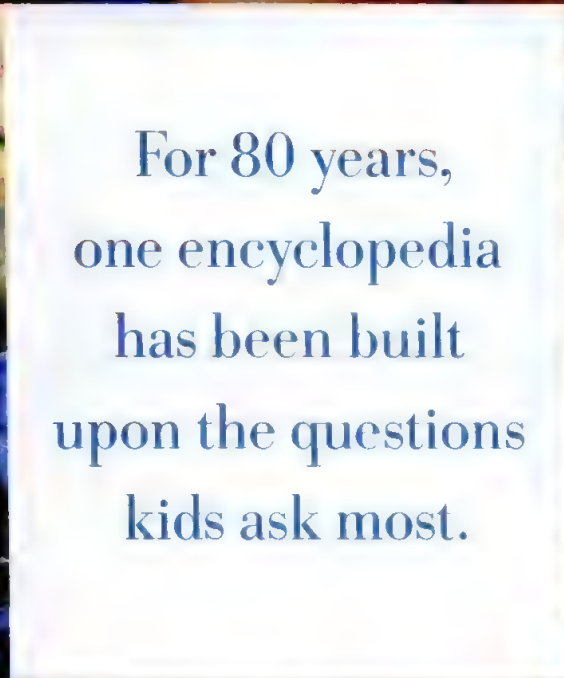
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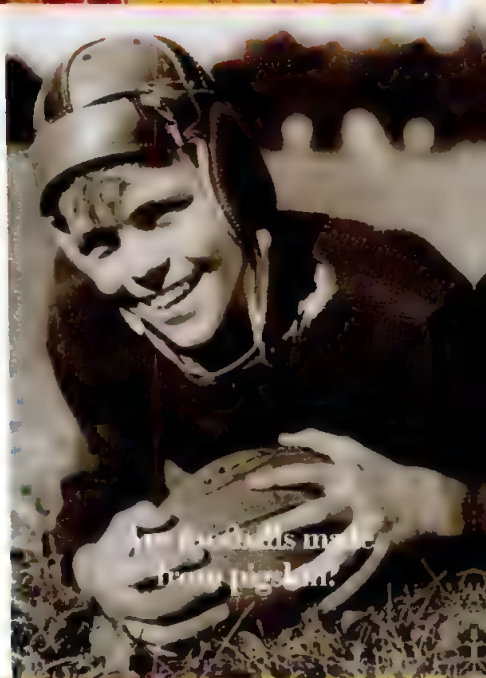
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Who invented zero?



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one encyclopedia
has been built
upon the questions
kids ask most.



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Why is Mars red?



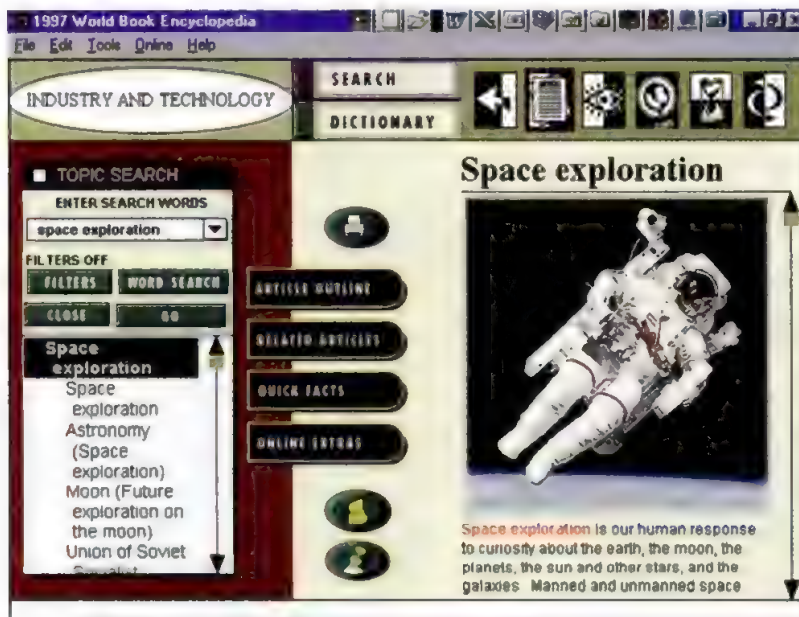
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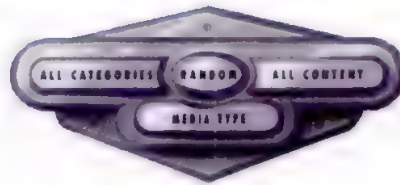
Get the facts fast. We've created a number of tools to make your time more productive. Interactive simulations help kids grasp complex topics quickly, like the concept of flight, or how an engine works. Sticky Notes lets you mark text and leave notes for future reference. Time Frame conducts searches by year, decade, century or millennium.



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For a live demonstration, drop by our Web site at www.pc.ibm.com/multimedia. Or call 1 800 426-7235, ext. 5209, for more information.



Each screen is designed to be friendly and easy to use. The simple, graphic interface means you won't waste time scrolling to pinpoint what you need.

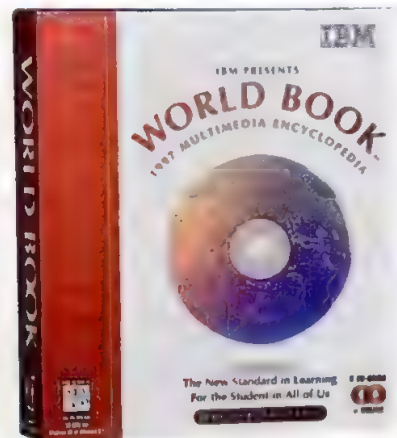


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SPIDs by itself, a feature that Adtran calls Automatic SPID and Switch Detection. The Adtran Express XRT required us to enter the AT command setup strings for the unit manually in the Dial-Up Networking properties menu, which is an inconvenience shared by the other external adapters we reviewed with the exception of the Connectware and 3Com products.

The included diagnostic software lets you monitor the status of the ISDN line and keeps a log of all your calls. If your ISDN line has two phone numbers, the Express XRT lets you route incoming calls from either ISDN number to either analog jack, which is a useful feature if you plan to replace your analog phone line with your ISDN line.

The Express XRT supports Hi/fn (formerly known as Stac) LZS hardware compression. Like most of the other products we tested, the Express XRT performed better using the compression in Windows 95 Dial-Up Networking than it did using the on-board Hi/fn hardware compression.

Adtran says that the Express XRT's serial port can run at speeds of up to 230.4 Kbps if you have a fast serial card in your PC.—*Les Freed*

Adtran Express XRT. List price: \$469. Adtran Inc., Huntsville, AL; 800-827-0807, 205-971-8000; www.adtran.com. Circle 445 on reader service card.

Cardinal Technologies Inc.

Cardinal IDC100i

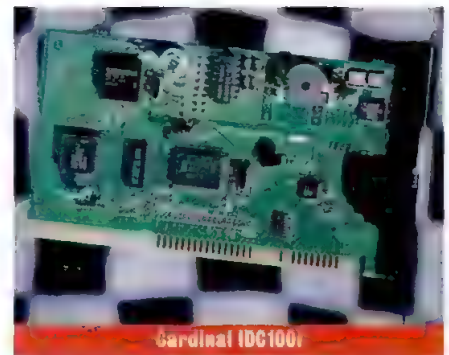
At \$199 list (\$190 street), the internal Cardinal IDC100i was easy to install and was the least expensive adapter in our roundup, but it offers only the most basic of features, with no analog ports. Furthermore, the Cardinal IDC100i had the lowest performance rating of the internal ISDN products we reviewed, and it offered no compression over a dual B-channel connection.

The IDC100i was fairly easy to install. Windows 95 automatically detected the Plug and Play-compatible card on booting up. Once Windows 95 is up and running you must continue with the Cardinal setup disks to install the rest of the utilities provided. The installation process also gives you the option of installing Microsoft Internet Explorer 2.0 and NetManager's Internet Chameleon 5.0.

Although you can use Windows 95's TCP/IP stack and Dial-Up Networking, the Cardinal IDC100i can make only Multilink PPP connections with NetManager's TCP/IP stack. Cardinal Technologies says it will release a fix by the time you read this.

Cardinal's management software is minimal, but it does put a helpful line-status indicator on the Windows 95 taskbar. The indicator shows the status of both B-channels by using different colors,

SUITABILITY TO TASK	
Cardinal IDC 100i	
Installation and configuration	Good
Connectivity	Fair



which is one of the Cardinal IDC100i's best features. This diagnostic utility will also automatically launch an online Troubleshooter, an interactive help file that aids in diagnosing problems.

Configuration of the card is neatly integrated into the Control Panel. To enter SPIDs, phone numbers, and switch types, you click on the System icon in the Control Panel, then click on the entry for the Cardinal card in the Network Adapters section. Cardinal was one of the few adapters in our roundup that allows for monitoring ISDN performance during live sessions using Windows 95's System Monitor.

Like the Connectware PhoneWorks, Digi DataFire, ISDN*tek CyberSpace, and U.S. Robotics DataBurst, the Cardinal IDC100i does not come with any ports for use with other analog telephone equipment, such as a fax or answering machine. This factor eliminates the Cardinal as a choice for those who want to be able

GLOSSARY

Glossary of ISDN Terms

Bandwidth Allocation Control Protocol (BACP)

A proposed protocol that works in conjunction with Multilink PPP to manage bandwidth dynamically. BACP lets two devices negotiate adding or subtracting bandwidth as needed.

Basic-rate interface (BRI) The basic ISDN setup, consisting of two 64-Kbps B-channels (bearer channels), which carry data and voice in both directions, and one 16-Kbps D-channel, which carries call-control information. A **primary-rate interface (PRI)**, on the other hand, consists of 23 B-channels (30 in Europe) and one D-channel.

Data over circuit-switched voice (DOCSV) An ISDN adapter feature that allows you to send data over a B-channel normally provisioned for voice,

avoiding per-minute tariffs often applied to ISDN data calls. In response to DOCSV, some phone companies are trying to eliminate flat-fee voice ISDN service.

ISDN ordering code (IOC) A predefined code that helps the phone company provision your ISDN line based on the setup of your ISDN hardware.

Multilink PPP (MP) A protocol that allows you to combine both B-channels for a total of 128 Kbps using synchronous PPP framing. Unlike the older hardware-based BONDING specification, MP is implemented in software and requires only that your communications software support the protocol.

NT-1 (Network Terminator Type 1) A device that converts a two-wire U-interface to a four-wire S/T

interface, allowing multiple PC and terminal connections. Most ISDN adapters sold in the U.S. have integrated NT-1s, so you don't need to purchase one separately.

POTS (plain old telephone service) An analog (nondigital) telephone line.

Provisioning The process of setting up device and service options that make up your ISDN line. When the telephone company provisions the line, it configures your ISDN service according to the physical capabilities of the switch, as well as for the options you choose.

Service Profile Identifier (SPID) A set of numbers assigned to your ISDN line by your phone company. One SPID is assigned to each B-channel.

ISDN/V.34 128 KBPS/33.6 KBPS UNDER \$600

At last you can have the best of both worlds – a V.34 33.6 Kbps modem with V.42 bis data compression and a 128 Kbps ISDN digital modem in a single PC Card (PCMCIA).

With Digi International's DataFire GO!™ Series ISDN/V.34 combination PC Card, notebook com-

puter users can now connect to ISDN at home and

V.34 on the road – all with a single PC Card. As a result, high-speed remote connections to corporate LANs or the Internet have never been easier or more affordable.



Digi combines ISDN and V.34 with the DataFire GO! PC Card for users of Windows notebooks.

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NETWORKING

ISDN Adapters

to use ISDN's analog telephone line capabilities.

Dial-Up Networking or the included Internet Chameleon can handle all data calls. Until Cardinal releases the fix that will allow you to use Multilink PPP under Dial-Up Networking, however, you may want to stick with Internet Chameleon as your dialer application, because switching between Dial-Up Networking and Internet Chameleon requires you to change your TCP/IP protocol stack within your network configuration.—*Andrew Go*
Cardinal IDC100i. List price: \$199. Cardinal Technologies Inc., Lancaster, PA; 800-775-0899, 717-293-3000; www.cardtech.com. Circle 446 on reader service card.

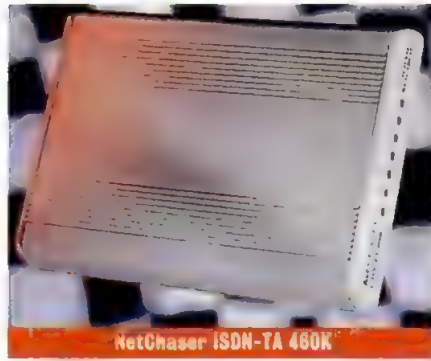
Chase Research Inc.

NetChaser ISDN-TA 460K

The NetChaser ISDN-TA 460K (\$399 list, \$320 street) includes the basics: two analog ports, cabling, and configuration software. More full-featured adapters, such as the Courier I-modem or ZyXEL's Omni TA128, are more attractive for those who want external units in this price range. With Chase Research's market focus on resellers and licensees, you may see versions of this adapter sold by other vendors, such as Boca Research.

Installation is handled well enough by the no-frills NetChaser Configuration for Windows. While not as slick as Adtran's or 3ComImpact's wizards, NetChaser's Help Buddy guides you adequately through installation. You enter switch, SPID, and directory numbers into pull-down menus under the Network window, and the Voice area assigns numbers for incoming calls to the analog ports. The software stores four different profiles, each with one or two B-channels and optional V.42bis compression.

To use Windows 95 Dial-Up Networking with the NetChaser, you'll need to add AT command strings to your configuration to implement the profiles created during setup. To set up dual B-channel calls, you must add the plus sign between the numbers for each channel—an undocumented procedure. The manual covers installation, technical references, and an ISDN tutorial; it was lacking detailed



information on client setups, particularly for Windows-based machines.

The NetChaser proved to be a good performer on our tests, taking advantage of the MPPC compression in Dial-Up Networking. But initially we had problems maintaining a consistent server connection. When Chase sent us a new power supply for the unit, the connection problem seemed to clear up.

The NetChaser includes a \$30 offer for the two-port Chase I/OXtra 460 Adapter, designed to bypass the 115.2-Kbps limit of 16550 UART serial ports. If you use this serial-port accelerator

with the NetChaser, Chase claims you can achieve throughput of up to 460 Kbps.—*Jeffrey G. Witt*

NetChaser ISDN-TA 460K. List price: \$399. Chase Research Inc., Nashville, TN; 800-242-7387, 615-872-0770; www.chaser.com. Circle 447 on reader service card.

Connectware Inc.

PhoneWorks ISDN Ext

Although Connectware's PhoneWorks ISDN Ext (\$299 list price, \$270 street) was one of the easiest products to get up and running, it lacks a complete set of features compared with other external adapters in our roundup, and it has no support for analog devices other than the included headset. Because it was unable to use compression other than V.42bis, the PhoneWorks was also the slowest performer on our compressible-file tests. But on our noncompressible-file tests, its overall performance was comparable with that of other tested external adapters.

Installing the PhoneWorks ISDN Ext was exactly like installing an external

modem. Like the 3ComImpact, the PhoneWorks includes the necessary setup strings so you don't need to look for them and enter them manually. The PhoneWorks ISDN Configuration Manager lets you set basic ISDN parameters, such as phone numbers, SPIDs, switch type, channel speed, and protocols. You can also create and store multiple configuration settings, a great feature for quickly changing among remote-access sessions requiring unique adapter configurations. The Diagnostics portion of the Configuration Manager lets you do a hardware check on your adapter and examine your ISDN line status.

There are two LEDs on the front, one for power, one for line status. The unit has a serial connector and an RJ-11 connector for a telephone handset jack. A headset-and-microphone unit is also included.



To make analog phone calls with the PhoneWorks, you must use the PhoneWorks dialer on the PC in conjunction with the headset. For data calls, we used Windows 95's Dial-Up Networking. For Multilink PPP connections, you must enter both phone numbers of your destination separated by an ampersand. We could not make a data call and a phone call simultaneously even though we were using only one B-channel for the data call. The PhoneWorks was also one of the few products we looked at that lacked support for CHAP

(Challenge Handshake Authentication Protocol) authentication, which may be a concern for network administrators setting up remote LAN access.—*AG*

PhoneWorks ISDN Ext. List price: \$299. Connectware Inc., Richardson, TX; 800-809-4029, 972-907-1093; www.connectware.com. Circle 448 on reader service card.

SUITABILITY TO TASK

NetChaser ISDN-TA 460K

Installation and configuration	Fair
Connectivity	Fair

SUITABILITY TO TASK

PhoneWorks ISDN Ext

Installation and configuration	Good
Connectivity	Good

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PERFORMANCE TESTS

ISDN Adapters



Whether you're dialing the Internet or your corporate network, internal ISDN adapters generally outperform their external counterparts. On most tests, adapters that used Windows 95's built-in compression had better results than those that didn't.

What the Numbers Mean

The type of data you'll typically encounter on the Internet is designed for slow connections. Mostly, it's either small files that make up Web pages or precompressed files for downloading. We simulated this type of data with our noncompressible file test. When we tested with one B-channel, we found that all of these adapters performed similarly. With two B-channels, all the external products were constrained by the serial-port speed of 115.2 Kbps except for U.S. Robotics' DataBurst, which has a parallel-port interface. With compression, the internal products, such as Diamond's NetCommander, the Digi DataFire, and Motorola's BitSurf Pro ISA, offer four times the throughput of a modem connection.

For remote access to a corporate network, you're likely to encounter files that are more compressible. To evaluate the adapters' compression schemes, we transferred a compressible text file across one and two B-channels. Again, over one B-channel, we found the adapters performed comparably, with some exceptions: The Cardinal IDC100i did not match the performance of the other internal adapters; similarly, Connectware's PhoneWorks and ZyXEL's Omni TA128 fell well short of the other external adapters.

An internal adapter typically includes a device driver that allows the adapter to be configured like a network adapter, and therefore is able to take advantage of Windows 95's ISDN support for the Point-to-Point Protocol (PPP) and Multilink PPP (MP). Microsoft's ISDN Accelerator Pack 1.1 for Windows 95 includes

Microsoft Point to Point Compression (MPPC) as well as compression licensed from Stac (now known as Hi/fn). Unlike Hi/fn LZS compression (which is built into several adapters), MPPC allows data to be compressed and decompressed using the PC's CPU before it is sent to the ISDN adapter. This creates a data stream that is unconstrained by the system's serial port (most serial ports in today's PCs have 16550 UART chips that have a 115.2-Kbps limit, though higher-speed serial-port products are available).

Under Windows 95, external adapters do not have the direct support advantages that internal adapters have; they have to provide their own PPP and MP implementations. This may explain why over both single and dual B-channel connections, Connectware's PhoneWorks and ZyXEL's Omni were unable to negotiate client compression, yielding results closer to our modem's compressible performance than to that of other external adapters.

The advantage of the direct Multilink PPP support that Windows 95 provides for internal adapters showed in particular on our compression tests with two B-channels. On these tests internal adapters—led by Diamond's Supra NetCommander ISDN, the Digi DataFire, and Motorola's BitSurf Pro ISA—bested the external ones, though many external adapters yielded quite impressive performance. An exception was the Cardinal IDC100i; its driver could not take full advantage of Windows 95 compression. Furthermore, because the Cardinal could not use Windows 95 ISDN support at all on our compressible-file tests with two B-channels, we used NetManage's TCP/IP stack, which has no compression capabilities; the result was lower throughput.

Adapters that include Hi/fn hardware compression can offer compression separate from Windows 95. You can see how this design affected the three U.S. Robotics units on our tests with two B-channels. The internal DataBurst and Sportster (which currently use the older Accelerator Pack 1.0) and the external Courier I-modem were unable to use MPPC for dual B-channel calls. The Sportster and DataBurst offer excellent results using their built-in Hi/fn compression, which was compatible with compression in our Ascend MAX 1800 router (though we had to switch the router's settings from MPPC to Hi/fn compression). Because this compression takes place in the adapter, the Courier was constrained by the serial-port speed. Over single-channel connections, however, the

Diamond Multimedia Systems Inc.

Supra NetCommander ISDN



Diamond Multimedia Systems' Supra NetCommander ISDN is an internal ISDN adapter that hits all the hot buttons. The NetCommander, our Editors' Choice among internal adapters, offers Windows 95 Plug and Play, a full-featured analog port, excellent performance, and innovative software—all at a show-stopping low list price of \$249 (\$230 street). Diamond also offers an ISDN line-ordering service, ISDN Now! (www.isdnnow.com), to help users set up service and Internet access.

The NetCommander is Diamond's first foray into the ISDN marketplace, and the company clearly did its homework: The Plug and Play-compatible NetCommander practically installs itself. A rear-panel LED provides visual confirmation that the ISDN line is working. The simple software installation sets up Microsoft's ISDN Accelerator Pack 1.1. We installed our NetCommander in under 10 minutes.

The NetCommander is a pleasure to use. Diamond's AutoISDN software displays each B-channel graphically. When you make or receive a voice or data call, the AutoISDN screen displays the call type, the remote phone number, the call duration, and Caller ID (where available) information. The AutoISDN program also pro-

vides a useful connection log as well as configuration and diagnostic tools.

The NetCommander posted excellent scores on our performance tests. Because it is designed specifically for Windows 95, the NetCommander doesn't have on-board hardware compression, relying instead on Windows 95 Dial-Up Network-

SUITABILITY TO TASK

Supra NetCommander ISDN	
Installation and configuration	Excellent
Connectivity	Excellent



Courier makes good use of the Hi/fn compression.—*Analysis*
written by Jeffrey G. Witt

How We Tested

Our test-bed consisted of HP Vectra XU 5/90Cs clients running Windows 95. We used National ISDN-1 lines to connect to an Internet service provider or our internal test router, an Ascend MAX 1800 with multiple BRIs. We configured the router for MPPC compression, Multilink PPP, and PAP (Password Authentication Protocol) authentication, and connected it to our Ethernet network to access

our HP LX NetServer Pro test server running Windows NT Server 3.51 and Microsoft Internet Information Server. We performed additional CHAP (Challenge Handshake Authentication Protocol) security and Hi/fn (Stac) compression testing to verify compatibility.

For our **Throughput** tests, we established an FTP session to our server and transferred two file types—a moderately compressible text file (compression ratio of 2.5:1), and a noncompressible random file (1:1.1)—to our client over a one B-channel and then over two B-channels. For comparison, we performed the same file-transfer tests with a U.S. Robotics Courier V. Everything 28.8-Kbps modem.

	Throughput, One B-channel		Throughput, Two B-channels	
	Noncompressible random file (Kbps)	Moderately compressible text file (Kbps)	Noncompressible random file (Kbps)	Moderately compressible text file (Kbps)
Adtran Express XRT	59.5	143.0	81.9	201.6
Cardinal IDC100i ¹	46.5	105.3	97.5	88.3
Chase NetChaser ISDN-TA 460K	59.5	150.6	84.6	206.5
Connectware PhoneWorks ISDN Ext	58.5	59.3	73.1	70.9
Diamond Supra NetCommander ISDN	59.2	152.4	113.8	297.7
Digi DataFire	61.0	173.0	120.5	294.3
ISDN*tek CyberSpace Internet+Plus Card	59.2	165.2	112.5	224.6
Motorola BitSurfr Pro	59.9	154.2	83.9	209.8
Motorola BitSurfr Pro ISA	60.2	158.0	116.4	275.3
3ComImpact IQ External ISDN Modem	57.5	140.7	80.0	167.3
U.S. Robotics Courier I-modem ²	59.2	147.1	113.3	83.9
U.S. Robotics DataBurst ISDN 128K ²	58.5	152.4	117.7	261.2
U.S. Robotics Sportster ISDN 128K ²	59.2	153.3	117.7	261.2
ZyXEL Elite 2864i	59.2	154.2	85.3	209.8
ZyXEL Omni TA128	59.9	87.1	83.9	87.1
Standard 28.8-Kbps modem ³	24.8	66.7	24.8	66.7
	BETTER ►	BETTER ►	BETTER ►	BETTER ►

(1) For two B-channels, we tested this product using the NetManage TCP/IP stack.

(2) For two B-channels, we tested this product using U.S. Robotics' TurboPPP compression, with Windows 95 compression disabled.

(3) Reported for comparison.

ing's software-based MPPC compression. The NetCommander provides compression on both single- and dual-B-channel connections, for file-transfer speeds of more than 280 Kbps.

The NetCommander was the only ISDN adapter tested (besides ZyXEL's Omni TA128) that could add or remove the second B-channel as needed, without user intervention. This feature switches dynamically between single- and dual-B-channel operation, saving on telephone and ISP charges.

The NetCommander's single analog port lets you connect up to three devices. The NetCommander supplies ring voltage to the analog jack on incoming calls, which lets you use answering machines, fax machines, and analog modems. Voice quality on the NetCommander's analog

port was excellent.—*LF*

Supra NetCommander ISDN. List price: \$249. Diamond Multimedia Systems Inc., San Jose, CA; 800-468-5846, 408-325-7000; www.diamondmm.com. *Circle 449* on reader service card.

Digi International Inc.

Digi DataFire

Digi International's Digi DataFire, an internal ISDN adapter (\$595 list price, \$450 street), was one of the most expensive products we reviewed but a strong performer on our throughput tests. First introduced in 1994, the DataFire is the granddaddy of internal ISDN boards. The DataFire lacks Plug and Play support and has no ports for

connecting analog devices, but it provides solid ISDN connectivity.

The DataFire was simple to install and worked correctly the first time, which is something we've come to appreciate in any ISDN product. In order to make a Multilink PPP connection, however, we had to download an updated driver from the Digi Web site. Because the adapter is not Plug and Play-compatible, you must set a DIP switch to select the board's I/O address before you install the Digi DataFire. The DataFire doesn't need an IRQ; this is noteworthy if you're considering setting up this card up in a remote-access server, because it will cause no interrupts, resulting in less strain on the server. Software installation is a simple process that takes about 10 minutes.

SUITABILITY TO TASK

Digi DataFire

Installation and configuration	Good
Connectivity	Fair

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The DataFire supports Microsoft's recently released ISDN Accelerator Pack 1.1, but we had to download the updated drivers: They were not included with the product. This software adds full ISDN support directly to Windows 95. The new drivers allow users to choose single or dual B-channels on a call-by-call basis. You can add or remove the second B-channel at any time without dropping the connection (provided you initiated the call using two B-channels).

The DataFire connected to all of our test routers and ISP services with no glitches. It was the leader on our single-B-channel tests and was bested only by Diamond Multimedia's Supra NetCommander ISDN on our two-B-channel compressible-file test. It's a good, reliable ISDN adapter, but the Supra NetCommander and U.S. Robotics' Sportster ISDN 128K offer similar performance and more features for less money.—*LF Digi DataFire*. List price: \$595. Digi International Inc., Minneapolis, MN; 800-344-4273, 612-912-3444; www.digibd.com. Circle 450 on reader service card.

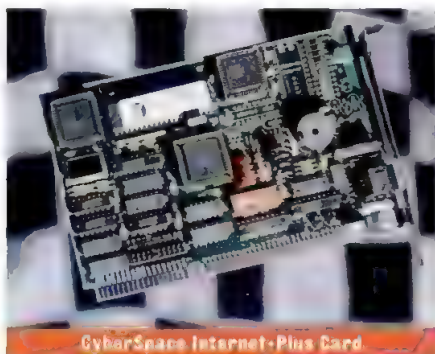
ISDN*tek Inc.

CyberSpace Internet+Plus Card

Though ISDN*tek's CyberSpace Internet+Plus Card performed well on our tests, it's a bit dated compared with the other internal adapters here, with neither analog ports nor Plug and Play support. Its \$695 list price (\$560 street) also makes it the most expensive product we reviewed. Other products in our roundup, such as Diamond Multimedia System's Supra NetCommander ISDN and U.S. Robotics' Sportster ISDN 128K, provide more

features for less than half the price.

The CyberSpace shows its age during installation. Before placing the ISA card into your PC, you must first determine a free address range and IRQ, and set them with a switch block and jumpers. A new version of this card with Plug and Play capability should be available sometime in 1997. The manual was also out of date; it didn't match the information on the installation disk. We found current installation instructions in a READ.ME file. Before installing drivers for the CyberSpace card, you must have Dial-Up Networking and Microsoft's ISDN Accelerator Pack 1.1. Once installed, the card was one of



the most robust in this roundup and worked flawlessly through all our tests.

The CyberSpace card has minimal management features. The configuration software shows a graphical version of the switch block and jumpers on the card, but you must change the settings on the card itself. The configuration software includes fields for entering SPIDs and phone numbers, as well as a diagnostic utility that lets you test both the card and ISDN line.

Like the Cardinal IDC100i, Connectware's PhoneWorks, the Digi DataFire, and U.S. Robotics' DataBurst, the CyberSpace Internet card does not have any analog ports, but ISDN*tek does offer the Commuter card line, which contains a handset jack for analog calls.

We easily made data calls using Windows 95's Dial-Up Networking. Dual-channel calls required us to specify the card's second channel as an additional device within Dial-Up Networking. Depending on your remote site's configura-

tion, you can specify a different telephone number or enter the same one to launch the second B-channel.—*AG*

CyberSpace Internet+Plus Card. List price: \$695. ISDN*tek Inc., San Gregorio, CA; 415-712-3000; www.isdntek.com. Circle 451 on reader service card.

Motorola Information Systems Group

BitSurfr Pro, BitSurfr Pro ISA

The BitSurfr Pro family offers some of the most complete packages in our roundup. The external BitSurfr Pro, an Editors' Choice in our previous roundup, is now joined by an internal version, the BitSurfr Pro ISA (both products are \$495 list, \$400 street). Commendable installation tools, a useful software bundle, and Motorola's ISDN-line ordering service make either one a reasonable buy.

BITSURFR PRO

Motorola has continually improved the BitSurfr Pro, one of the first affordable ISDN adapters. The ISDN Surfr Setup software has been updated to simplify configuration, particularly for Windows 95 users. The unit includes a standard serial-port interface and two ports for analog devices. The NetManage Internet Chameleon software is included for Internet access, and Windows

3.x users can use the NetManage TCP/IP stack and Pacific CommWare's TurboCom/2 communications driver.

The ISDN Surfr Setup interface makes installing the BitSurfr Pro easy. After you enter the SPIDs and directory numbers, the program's diagnostics verify the setup, confirming the ISDN line, switch type, and data/voice ports. As good as the software is, however, it didn't match the autosensing capa-



SUITABILITY TO TASK

CyberSpace Internet+Plus Card

Installation and configuration	Fair
Connectivity	Fair

SUITABILITY TO TASK

BitSurfr Pro

Installation and configuration	Good
Connectivity	Good

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SUMMARY OF FEATURES

ISDN Adapters



	Adtran Inc. Adtran Express XRT	Cardinal Technologies Inc. Cardinal IDC100i	Chase Research Inc. NetChaser ISDN-TA 468K	Connectware Inc. PhoneWorks ISDN Ext	Diamond Multimedia Systems Inc. Supra Net-Commander ISDN	Digi International Inc. Digi DataFire	ISDN*tek Inc. CyberSpace Internet+Plus Card	Motorola Information Systems Group BitSurfr Pro
■ YES ■ NO								
In alphabetical order by company								
List price	\$469	\$199	\$399	\$299	\$249	\$595	\$695	\$495
Internal or external	External	Internal	External	External	Internal	Internal	Internal	External
External dimensions (HWD, in inches)	1.6 x 9.0 x 6.4	N/A*	1.2 x 5.6 x 7.6	1.5 x 4.0 x 6.5	N/A*	N/A*	N/A*	1.5 x 6.4 x 5.3
Supports Caller ID	■	■	■	■	■	■	■	■
Supports AT command set	■	■	■	■	■	■	■	■
Hardware								
Processor	Motorola 68302	Siemens 2091	Motorola 68302	Motorola 68302	AT&T 7256	Motorola 572	Siemens 2085	Motorola 68302
Integrated analog modem	■	■	■	■	■	■	■	■
Supports data over circuit-switched voice	■	■	■	■	■	■	■	■
Number of serial ports	2	N/A*	1	1	N/A*	N/A*	N/A*	1
Number of parallel ports	0	N/A*	0	0	N/A*	N/A*	N/A*	0
Number of RJ-11 ports	2	0	2	1	1	1	1	2
Supports analog communications devices	■	N/A*	■	■	■	■	■	■
Supports ring-through	■	N/A*	■	N/A*	■	N/A*	N/A*	■
Ringer equivalence number	3	N/A*	3	N/A*	3	N/A*	N/A*	3
Includes flash ROM	■	■	■	■	■	■	■	■
Supports PAP/CHAP security protocols	■	■	■	■	■	■	■	■
Can add second B-channel automatically	■	■	■	■	■	■	■	■
Software								
Protocols supported:								
PPP/Multilink PPP/Synchronous PPP	■	■	■	■	■	■	■	■
V.120/BONDing	■	■	■	■	■	■	■	■
Windows 95 Plug and Play-compatible	■	■	■	■	■	■	■	■
Can use Windows 95 TCP/IP stack	■	■	■	■	■	■	■	■
TCP/IP stack included	None	NetManage	None	None	None	None	None	NetManage
Supports Win 95 ISDN Accelerator Pack 1.1	N/A**	■	N/A**	N/A**	■	■	■	N/A**
Bundled telephony software	■	■	■	■	■	■	■	■
Bundled fax software	■	■	■	■	■	■	■	■
Compression:								
Hi/fn LZS-compatible (formerly Stac LZS)	■	■	■	■	■	■	■	■
Other compression schemes	Ascend, MPPC	None	MPPC, V.42bis	V.42bis	MPPC	MPPC	MPPC	MPPC
ISDN switch types supported:								
AT&T 5ESS/Northern Telecom DMS 100	■	■	■	■	■	■	■	■
National ISDN-1/ISDN-2	■	■	■	■	■	■	■	■
Other	None	None	Ericsson	Siemens	None	None	Siemens	None
Technical support								
Vendor will provision ISDN line	■	■	■	■	■	■	■	■
Warranty (parts and labor)	5 years	Lifetime	Lifetime	3 years	5 years	5 years	1 year	5 years
Technical-support number	800-823-8726	717-293-3124	800-242-7387	800-357-0852	408-325-7110	800-344-4273	415-712-3000	800-221-4380
Technical-support hours (eastern time)	24 hours, 7 days	8:00-8:00 M-F	9:00-6:00 M-F	9:00-6:00 M-F	8:00 A.M.-10:00 P.M. M-F, 11:00-7:00 Sat.	8:30-7:00 M-F	11:00-8:00 M-F	8:00-8:00 M-F

N/A*—Not applicable: The product does not have this feature. N/A**—Not applicable: This product uses AT commands.
(1) The product supports this feature using only one B-channel. (2) The product supports only Win 95 ISDN Accelerator Pack 1.0.

bilities and installation wizards of the Adtran and 3Com products.

The six LEDs on the unit are informative, but you'll need to learn the flashing sequence in order to identify single- or dual-B-channel activity. Our performance tests showed the BitSurfr Pro to be the equal of any external adapter for non-compressible files and to be better than average when using Windows 95 Dial-Up

Networking's software compression on moderately compressible files.

BITSURFR PRO ISA

Motorola's entry into the internal ISDN adapter market takes a unique approach: The BitSurfr Pro ISA is installed as a modem, whereas the other internal adapters in our roundup behave like LAN adapters. The downside of this approach

is that it requires two IRQs. One interrupt is assigned as a standard hardware COM port and the other as a virtual software COM interface. Users who don't have spare IRQs will find this unacceptable.

The BitSurfr Pro ISA comes with the same features as its external cousin—two analog ports, and the same configuration routine and bundled software. With its internal modem approach, the BitSurfr Pro



Motorola Information Systems Group 312/San Francisco, CA	3Com Corp. 3Com/Impact 10 External ISDN Modem	U.S. Robotics Inc. Courier 1-modem	U.S. Robotics Inc. DataBurst ISDN 128K	U.S. Robotics Inc. Sportsster ISDN 128K	ZyXEL Communications Inc. Elite 2864	ZyXEL Communications Inc. Omni TA128
\$495	\$499	\$399	\$279	\$299	\$449	\$399
Internal	External	External	External	Internal	External	External
N/A*	1.6 x 8.7 x 5.4	1.3 x 6.4 x 10.3	1.3 x 5.5 x 3.8	N/A*	1.9 x 7.3 x 9.0	1.5 x 7.2 x 5.3
						

Motorola 68302	Motorola 145572	Texas Instruments/USR	Texas Instruments/USR	Texas Instruments/USR	Siemens 2086	Siemens 2091
N/A*	1	1	0	N/A*	1	2
N/A*	0	0	2	N/A*	1	0
2	2	1	0	1	1	2
			N/A*			
			N/A*			
3	3	3	N/A*	Optional	1	1

NetManage	None	Stampede	None	None	None	None
N/A**	N/A**	N/A**	N/A**	N/A**	N/A**	N/A**
MPPC	MPPC	Ascend, MPPC	Ascend, MPPC	Ascend, MPPC	MPPC, V.42bis	V.42bis
None	Siemens	None	None	None	None	None

 5 years 800-221-4390 8:00-8:00 M-F	 5 years 800-572-3266 24 hours, 7 days	 5 years 800-550-7800 8:00-8:00 M-F	 5 years 800-550-7800 8:00-8:00 M-F	 5 years 800-550-7800 8:00-8:00 M-F	 2 years 714-693-0808 11:00-8:00 M-F	 2 years 714-693-0808 11:00-8:00 M-F
--	---	--	--	--	---	---

ISA does not offer the diagnostic or real-time statistics of other internal adapters such as the NetCommander. You also cannot access activity status or B-channel conditions, though Motorola promises a free downloadable Virtual LED program in the future.

Both BitSurfr adapters successfully negotiated PAP authentication with our Ascend

test router. The BitSurfr Pro ISA tested well, placing close to the top-performing Digi DataFire and the NetCommander.

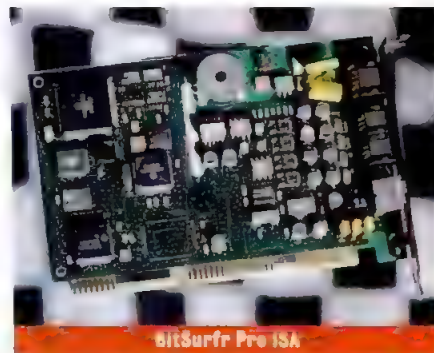
The BitSurfr adapters are the only prod-

ucts in our roundup to offer an uninterruptible power supply option. The BitBrick (\$20 with ISA, \$75 with the external model) provides 4-hour battery backup when there is a power

SUITABILITY TO TASK

BitSurf Pro ISA

Installation and configuration	Good
Connectivity	Good



BitSurf Pro ISA

loss or, in the case of the ISA model, when the PC is powered down.—JGW

BitSurfr Pro. List price: \$495. **BitSurfr Pro ISA.** List price: \$495. Motorola Information Systems Group, Huntsville, AL; 800-426-6336, 205-430-8000; www.mot.com.
Circle 452 on reader service card.

3Com Corp.

3Com Impact IQ External ISDN Modem



PC
MAGAZINE
EDITORS' CHOICE

The 3ComImpact IQ External ISDN Modem (\$499 list, \$350 street) is the company's second-generation external ISDN adapter. The original 3ComImpact was mediocre, but 3Com Corp. has got it right this time around. The product combines good performance, two analog ports, painless installation, and a full suite of software to provide the best bang for the buck among the tested products. Also, 3Com—like Motorola and U.S. Robotics—includes a free ISDN line-ordering service.

The 3ComImpact is housed in an attractive, modem-size box. Two RJ-11 jacks on the rear panel provide excellent analog telephone connections. The front panel contains eight status LEDs that show power, ISDN-line, and serial-port status.

With every other product here (except for the Adtran Express XRT), you must enter your ISDN phone numbers, the central-office switch type, and the SPIDs before it will place a call. The 3ComImpact's SPID Wizard installation software needs to know only your ISDN number; the wizard figures out the rest by itself.

The setup software also sends a default string to the unit, so you don't have to enter it manually. We had our test unit working in less than 10 minutes. Moreover, the product was one of the few test-



ed terminal adapters that connected to each of our test routers on the first try.

The 3ComImpact includes Hi/fn (formerly known as Stac LZS) data compression.

If you aren't using Windows 95 Dial-Up Networking, which includes its own MPPC compression, you select this compression option. One of the 3ComImpact's only drawbacks is that it can do CHAP authentication only on one B-channel.

Included are a 6-foot serial cable, an ISDN line cable, and installation software for Windows and Macintosh computers. There's also a CD-ROM of software, which contains Backstage Designer, Eudora Lite, Microsoft Internet Explorer 2.0, TeleVox, and sign-up offers from Internet service providers.—LF

3ComImpact IQ External ISDN Modem. List price: \$499. 3Com Corp., Santa Clara, CA 95052; 800-638-3266, 408-764-5000; www.3com.com. Circle 453 on reader service card.

U.S. Robotics Inc.

Courier I-modem, DataBurst ISDN 128K, Sportster ISDN 128K

No matter how you want your ISDN adapter, U.S. Robotics has you covered. The company offers three very different ISDN adapters at three different price points. The Courier I-modem (\$399 list, \$370 street) connects to a serial port, the new external DataBurst ISDN 128K (\$279 list, \$260 street) can share a parallel port with your printer, and the Sportster ISDN 128K (\$299 list, \$250 street) is an ISA card. Like Motorola and 3Com Corp., U.S. Robotics offers customers an ISDN line-ordering service to ease the move to ISDN.

The two less expensive adapters provide better ISDN performance over two B-channels. Because none of the three products could use Windows 95's compression over a dual B-channel connection (though each could over a single channel), we tested them using the company's hardware-based TurboPPP compression on our two B-channel tests. The Sportster and DataBurst returned better results with TurboPPP on these tests, but the Courier didn't see the same benefit.

COURIER I-MODEM

The Courier I-modem is available in internal and external models, with a U or an

S/T interface, and with or without an analog port. We tested the model 1 external, which

includes a U interface and a single analog port. The bare-bones model with an S/T interface (requiring a separate NT-1) and no analog port has a list price of \$339.

Because it incorporates the company's V.Everything modem technology, the Courier is compatible with all modem standards in use today, including V.34 and older standards. U.S. Robotics has announced plans for a firmware upgrade to the Courier to add support for U.S. Robotics' x2 56-Kbps modem technology.

The Courier was easy to install and set up, though we had to download an updated driver. The one-screen installer program is simple to use, providing on-screen confirmation that your modem is correctly configured. The Plug and Play-compatible Courier includes an .INF file that provides configuration information for use with Windows 95 Dial-Up Networking. But the product does not



include the necessary AT setup string. (This was also the case with the other external adapters we tested—with the exception of the adapters from Connectware and 3Com Corp.) The analog jack provides clean phone connections, and the 13 status LEDs show detailed status information at a glance.

If you want a product that can talk to just about any modem or ISDN device on the planet, this may be for you. But most users may be better off using a separate modem and ISDN adapter.

DATABURST ISDN 128K

U.S. Robotics' newest and least expensive ISDN product, the DataBurst ISDN 128K, has the unique ability to bypass the serial-port bottleneck by connecting to the parallel port. This gives you throughput comparable to that of an internal adapter, but without the installation hassles.

Installation is a snap, since it requires no addresses or IRQs. You simply plug the pass-through parallel connector between your PC and printer, connect the ISDN line and power supply, and run the installation program. The DataBurst manager program is similar to the Sportster's software and provides the same monitoring, logging, and configuration features. Like the Sportster, the DataBurst uses the Accelerator Pack 1.0 and was incompatible with Version 1.1.

The DataBurst turned in excellent test scores once we disabled Windows 95 compression and used TurboPPP; it virtually matched the performance of the internal Sportster. The DataBurst doesn't provide analog support (the only external product that doesn't, besides the Connectware adapter), which is disappointing in a product that is clearly aimed at the home mar-

SUITABILITY TO TASK

3ComImpact IQ External ISDN Modem

Installation and configuration	Excellent
Connectivity	Excellent

SUITABILITY TO TASK

Courier I-modem

Installation and configuration	Fair
Connectivity	Good

SUITABILITY TO TASK

DataBurst ISDN 128K

Installation and configuration	Excellent
Connectivity	Good



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ket. Our only other quibble is the absence of LEDs to indicate data transmission; the three LEDs on the front panel show power and ISDN line status. At \$279, the DataBurst provides excellent bang for the buck, and it's a good choice for users who don't require analog connections.

SPORTSTER ISDN 128K

An Editors' Choice in our last ISDN roundup, the Sportster ISDN 128K provides outstanding performance and excellent software, although its analog features need improvement. The installation program automatically installs Microsoft's ISDN Accelerator Pack 1.0. (The product as tested is incompatible with the Accelerator Pack 1.1.) The setup process is quick and easy, and the software is among the best we've seen.

The Plug and Play-compatible Sportster card requires one IRQ line and a small range of I/O addresses, but it does not need a COM-port address. The Sportster Manager software provides configuration, logging, and monitoring in one simple program. A clever graphics display shows the status of the ISDN line at a glance, and a call-logging feature provides detailed information about each call.

The single analog port works well for outgoing calls, but when you receive an incoming call, the Sportster sounds a beeper rather than ringing an attached phone. If you prefer, for \$95 you can buy an external ring generator, which generates the 90-volt signal required to use phones, fax machines, and answering machines.—*LF*

Courier I-modem. List price: \$399. **DataBurst ISDN 128K.** List price: \$279. **Sportster ISDN 128K.** List price: \$299. U.S. Robotics Inc., Skokie, IL; 800-342-5877, 847-676-7010; www.usr.com. *Circle 454 on reader service card.*

ZyXEL Communications Inc.

Elite 2864I, Omni TA128

ZyXEL Communications has attempted to stamp versatility and unique features on its line of ISDN adapters. The Elite 2864I (\$449 list, \$370 street) offers a built-in V.34 modem and serial- and parallel-port interfaces to connect to your PC. The Omni TA128 (\$399 list, \$330 street), aimed squarely at home- and small-office users, allows a single ISDN line to be shared for simultaneous use by two separate systems. But despite these innovations, you'll need patience to get the products operational, and both could use configuration wizards and clearer documentation.

Each unit performed adequately on our noncompressible file tests. But on the moderately compressible file tests the Omni was unable to use Windows 95 Dial-Up Networking's software compression, resulting in lower throughput. The Elite, which did use the Microsoft compression, matched the best external performers.

ELITE 2864I

Besides serial- and parallel-port interfaces, the Elite includes modem, fax, and voice capabilities, a single analog port, and head-phone and speaker jacks. On our tests, we

were able to switch between modem and ISDN use without a problem. The status of nearly every function—including sin-

gle or dual B-channel use—is reported by one of the 21 LEDs. Both the Elite and Omni are capable of flash ROM upgrades.

Via the serial port, Windows 95 detected the Elite and installed it as a modem. As



with the Omni, the Elite's setup required us to enter AT commands manually—a drawback shared by all the external adapters reviewed except those from Connectware and 3Com. We could not configure the Elite's parallel port to work with

our test system, and ZyXEL's technical support could not walk us through the installation.

The graphical ISDN Configuration Manager program was easy to use. The software

handled switch type and SPIDs without a hitch, but the section for defining the B-channel protocol or number of channels apparently didn't work.

OMNI TA128

The Omni TA128 has two ports for connecting analog devices, and—unique among the products here—includes a second serial port to allow two PCs 64-Kbps access at the same time. To use the

two serial ports, you must set the unit explicitly in this mode through a terminal program from the primary system. The second system must be configured in the same way. But a bug—which ZyXEL is repairing—causes Windows 95 on the second system to report that the Omni is inoperable, though this does not affect operation of the adapter. Also, splitting the ISDN line between two users disables one of the analog ports.

Besides the Supra NetCommander ISDN, the Omni is the only adapter here to include a true bandwidth-on-demand feature, which automatically adds the second B-channel when needed.—*JGW*

Elite 2864I. List price: \$449. **Omni TA128.** List price: \$399. ZyXEL Communications Inc., Anaheim, CA; 800-255-4101, 714-693-0808; www.zyxel.com. *Circle 455 on reader service card.*

SUITABILITY TO TASK

Elite 2864I

Installation and configuration	Fair
Connectivity	Fair

SUITABILITY TO TASK

Sportster ISDN 128K

Installation and configuration	Excellent
Connectivity	Good

SUITABILITY TO TASK

Omni TA128

Installation and configuration	Fair
Connectivity	Good



Under
\$300



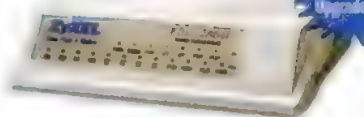
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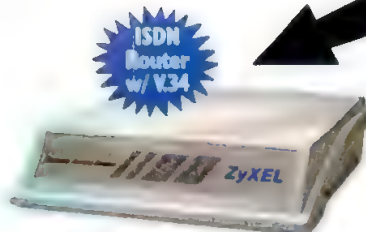


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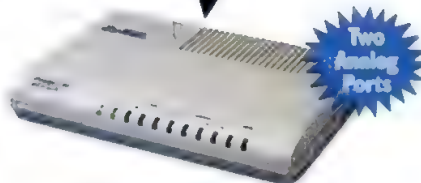
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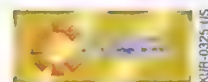
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Hardware

Just One Step Away

CD-R bundles are affordable and approachable, but still one step shy of being right for everyone.

By Jonathan Hill



Searching for the best tool you can use to share, transport, or archive large amounts of data without having to worry about proprietary hardware formats and compatibility? Then compact disk-recordable (CD-R) technology may be right for you. The drives are cheaper than in the past (some are less than \$500), and more user-friendly software is making the devices as simple to use as the common tape backup drive.

As the name implies, CD-R enables you to create your own CD-ROMs. Any CD-ROM drive can read the disks, which can hold up to 650MB. Such capacities are especially advantageous: The needs of the typical business user outstripped the 3.5-inch floppy disk's 1.44MB long ago, and although innovations such as SyQuest, Zip, and Jaz removable cartridge drives are viable solutions, they aren't perfect. To use the information on a Zip disk, for instance, a recipient must have a Zip drive. And if you want to take that data on the road, the drive has to come along for the ride.

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Backups, data sharing, transporting files

CD COPIES

Backups of CD-ROMs, audio CDs

MULTIMEDIA AUTHORIZING

Presentations, product demos, training disks

WHAT WE RECOMMEND

Hardware: Pentium-class machine, SCSI controller board (included with many CD-R bundles), Fast EIDE hard disk, EIDE CD-ROM drive.

Software: Premastering package (included with all tested bundles), dedicated backup package (such as Seagate Backup Exec) or UDF-compliant packet-writing architecture.

Note: In our testing, a full SCSI configuration worked most consistently in a standard EIDE setup.

WHAT WE RECOMMEND

Hardware: Pentium-class machine, SCSI controller board (included with many CD-R bundles), SCSI CD-ROM drive or 650MB hard disk space to hold image files, 2MB CD-R buffer memory.

Software: Premastering package; all tested bundles have functions expressly for copying CD-ROMs or audio tracks.

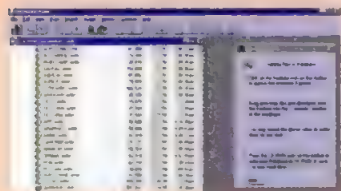
WHAT WE RECOMMEND

Hardware: Pentium-class machine, SCSI controller board (included with many CD-R bundles), AV-rated SCSI hard disk with 650MB space, 2MB CD-R buffer memory.

Software: Premastering package, multimedia authoring package, such as Amtech's IconAuthor for Windows (\$4,995), Corel's Click and Create (\$695), Macromedia's Authorware (\$4,995) or Macromedia's Director (\$850).

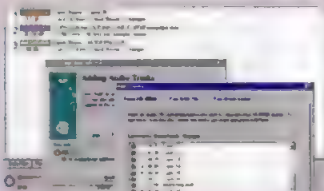
COPY AND PASTE

Packet-writing schemes let you copy and paste files to your CD-R drive.



IMAGE

This wizard in CD Creator walks you through the process of copying a CD-ROM disk.



SCRIPT AND BUILD

Multimedia authoring tools help you combine a number of multimedia elements into a coherent package.



BURN THE CD

Blank CD-R media are not all interchangeable; consult your drive's documentation for recommendations.

The advantage of CD-ROM storage is that it's universal: Nearly everyone's PC now has a CD-ROM drive, and a significant minority of laptops sold in the past two years are also so equipped. So you can create a presentation or training demo, distribute last year's financials, or store a slew of digital images and know that the information will be accessible to all who receive it. You can even use your CD-R drive to create music CDs or make backup copies of production CD-ROM disks. (And yes, that's legal as long as you purchased the CDs yourself and make copies only for personal use.)

The promise of CD-R hasn't been lost on mainstream PC users. Over the past

two years, the drives have evolved from multi-thousand-dollar units intended for professional content developers to \$500 tools aimed at business and power users. Shipments of retail CD-R bundles are growing rapidly, and several large systems vendors plan to include CD recorders with their standard PC offerings by year's end.

REVIEW CRITERIA

For this story we tested CD-R bundles (including the drive and all the necessary software and cables) that cost less than \$2,000 list and either were new or had changed substantively since our last roundup ("Cre-

ate Your Own CD," April 9, 1996). We also invited past Editors' Choice winners that are still on the market, to see how they would fare against the newer competition. We did not require the inclusion of a SCSI host adapter, though several units do include such adapters. (Note that all current CD-R drives require SCSI connections, though parallel-port implementations are on the way.) We tested 15 drives from 14 vendors.

Yamaha—a longtime player in the CD-R market and a major supplier of drive mechanisms—was putting the final touches on its CD-R 400, an \$849 (list) 4X-write/6X-read device, and did not

have a final version in time for testing. TEAC, another mechanism supplier, will be selling a branded retail bundle soon after you read this.

The group's less expensive drives can record disks at a speed of 2X (that is, they would write a 74-minute audio CD in 37 minutes), and they can read at 4X. The Philips EasyWriter has pushed the read speed to 6X, and you can expect to see other vendors move to faster read speeds as well. But don't expect to see CD-R drives reach the 12X read speeds of CD-ROM drives anytime soon: The mass of the dual read/write head makes the higher speeds difficult to attain. This roundup's more expensive drives record at 4X and are aimed at professionals who create many CDs.

Don't forget to read the fine print when you plan your purchase. Small variations, such as outdated firmware or stripped-down licensed versions of the software, can mean the difference between a successful recording session and a stack of wasted disks—which, at \$7 apiece in bulk, is no small loss.

Also, check on how much buffer memory the drive has. A larger amount will help avoid the dreaded *buffer underrun* error, in which a drive prematurely runs out of data to record and aborts the session. With memory costs bottoming out, CD-R drive buffers as large as 2MB are on their way to becoming commonplace.

Finally, during our testing we found some glitches that may make CD-R technology the wrong choice for many users. For instance, we found that for two of the most common CD-R tasks—copying CD-ROMs and audio CDs—you really need a SCSI-hosted CD-ROM drive. The vast majority of users, even those with new Pentium systems, will find they have IDE CD-ROM subsystems. Likewise, to copy many small sequential files from a hard disk to the CD-R drive, we ran into problems with our test-bed's IDE hard disk, whereas a SCSI hard disk made the process work flawlessly. See the sidebar "Performance Tests" for more details.

A WHOLE NEW BALL GAME

Many changes have been afoot in the CD-R arena since our last roundup. Last year, for instance, the majority of the drives we

Editors' Choice

• Sprezza CSP-9411S



Though CD-R drives are getting easier to use, you may still have trouble completing tasks because of the way the CD-R software and your system's hardware interact.

The best bundle helps you get over such hurdles.

In this roundup, the best combination of hardware and software belongs to the Sony Sprezza CSP-9411S (internal, \$799.99 list). The 2X-write/4X-read Sprezza is a snap to set up, and the included CD Creator 2.0 mastering software has handy wizards to guide you through most CD-R chores. More important, its 1MB buffer will help you avoid buffer underrun errors during on-the-fly recording.

Four other bundles in this roundup deserve honorable mention. A price/performance stand-out, the Philips EasyWriter (internal, \$599 street) is an excellent choice for CD-R novices. The 2X-write/6X-read bundle includes CD Creator mastering software as well as Seagate's popular Backup Exec software, which lets you use the CD-R drive as you would any standard tape drive. Based on the same 2X/6X mechanism as the Philips unit, the HP SureStore CD-Writer 6020es (internal, \$780 street) also merits honorable mention. It, too, is easy to use, thanks to a range of software applets that help you create and manage CD-R-based files.

tested included one of two competing software packages: Corel's CD Creator or Incat Systems' Easy-CD Pro. These packages still form the lion's share of CD-R software shipments (90 percent of the bundles we tested had one or the other); the difference is that the SCSI hardware and software giant Adaptec now owns both. For a closer look at their capabilities and how the competition stacks up, see the sidebar "Software: The Other Half of the Equation."

The second news peg is price. Last year CD-R drive bundles finally dipped below \$1,000. This time around, three of the re-

A third honorable mention goes to JVC's Personal Archiver Plus (\$500 street). JVC has gone its own route in the bundle department by including its own Personal Archiver software instead of one of the two packages from Adaptec. We found the software easy to master, and though the 2X-write/4X-read drive was a little slower on our tests than some of the others, it was able to complete more of our tasks. Moreover, the bundle's low price leaves you room to

purchase a third-party package should you outgrow JVC's.

For professionals who will burn CDs all day long, the time saved with a 4X recorder makes it well worth the extra cost. An honorable mention goes to the



Smart and Friendly CDR-4000/Pro (internal, \$899 list). Built around a proven Yamaha 4X/4X mechanism, this bundle includes a wealth of software for a very competitive price. Like other bundles in this roundup, the Easy-CD Pro 1.2 mastering software had difficulty with some of the on-the-fly recording tests on our IDE-based test-bed. If you connect it to a high-end PC with a SCSI hard disk and CD-ROM subsystems, however, there will be no apologies necessary.

viewed bundles sell for \$500 on the street. Finally, a new standard file format, CD-UDF, helps make CD-R drives more useful. A few years ago, you had to put all the data onto the disk in a single session. The advent of *multisession recording* enabled you to record to a disk over time. And CD-UDF, ratified last June by OSTA (the Optical Storage Technology Association), is the file format for a relatively new idea, *packet writing*. This technology reduces the disk overhead (and hence the wasted storage space) involved in linking multiple small sessions. UDF is compatible with the traditional file system stan-

HIGHLIGHTS

Bringing CD-R Home

Ease of use and free-falling hardware prices have helped compact disk-recordable bundles become mainstream peripherals. But check your PC system's specs before you take the plunge.

CD-R for everyone Just a few years ago, CD-R recorders cost \$25,000 and were difficult to use, making them the exclusive province of software developers who needed to test their CD-ROM titles. Today, a range of CD-R bundles is available, many selling for less than \$1,000 and some for as little as \$500. More than a few come complete with wizards to take you through each step of the recording process.

Data archiving, distribution, audio With the near-universality of CD-ROM drives, no other medium comes close to CD-R for sharing, transporting, or archiving information. With the right combination of hardware and software, CD-R lets you

easily create customized CD audio disks or make backups of your store-bought CD-ROM titles.

Getting started Before you choose a CD-R drive, make sure your system has the right stuff. A fast IDE or SCSI-based hard disk with 680MB free and a top-quality SCSI controller or PCI bus-mastering controller are basic requirements. If you plan to transfer audio or data directly from production CDs to CD-R, you will need a SCSI-based CD-ROM reader as well. Add a midrange audio-editing package and a little more time and effort, and you can even restore old LPs and tapes while transferring them to CD.

Future forecast CD-R is a write-once technology. You can use a disk only a single time. The newer compact disk-rewritable (CD-RW) drives, which let you rerecord disks, are available this year. Initially, those drives will cost around twice as much as comparable CD-R units, and disks will cost around \$25.

a top-end system to create (or "burn") a CD successfully, and the project was fraught with misfires and lots of aggravation. There was essentially one market for CD-R: software developers in large corporations, who used the drives to create test disks of their prospective CD-ROM titles. The DOS-based software used to create CDs was arcane, but if you knew your way around lead-ins, lead-outs, and error control blocks, you could get the job done—if you were careful.

High-end packages providing low-level control of every aspect of the burn are still available. But the designers of CD Creator and Easy-CD Pro have opted for the ease of use that mainstream users demand. In CD Creator, wizards take you by the hand and walk you step-by-step through the process. As explained below, there are several types of CD-ROM disks you can use for recording, and now you don't have

to know the gory details of each one. With each kind of disk—audio, CD-ROM/XA, PhotoCD, Enhanced CD, and so on—every parameter is already set for you.

COLORING BOOKS

The simplest and oldest CD standard in widespread use is the result of work that Philips and Sony did back in 1980. Distributed in binders with red covers, the specification became known as the *Red Book Standard for CD Audio*, and it still governs the format of every audio CD.

But Red Book does not describe any means of error detection or control. Although it is fine for recording digital audio destined for error-tolerant listeners, data files aren't useful unless they're error-free. In 1983 the Yellow Book standard for CD-ROM (distributed, appropriately enough, in binders with yellow covers) solved the problem. It broke down Red Book's 2,352-byte blocks into several sections, including sync and header areas, a 2,048-byte data area, and sections for error detection code and error correction code (EDC and ECC).

CD-ROM/XA (CD-ROM/extended architecture), based on the block structure of Yellow Book Mode 2, enabled the interleaving of data and audio blocks. This method, in turn, was the basis for the Orange Book specification.

Kodak and Philips provided the impetus for Orange Book with the PhotoCD format, which provided a way to add a new session without burying the previous one (so you could have a new roll of film added to your PhotoCD). Generally, every time you record on a CD-R disk, the last step is to embed a Table of Contents (ToC) at the end of the session, which provides the only way for a CD-ROM drive to determine where one file ends and the next begins. But since a CD reader can read only the last session's ToC, before the advent of Orange Book, every new session rendered the previous one inaccessible. The key advance of Orange Book (with PhotoCD's extensions) was the ability to provide each new ToC with pointers to the previous volume, allowing CDs you created in multiple sessions

dard, ISO 9660, but will eventually replace it. UDF will simplify drive letter access for CD-R devices, causing them to behave like any other attached drive.

Note that current packet-writing schemes (featured by seven drives in this roundup) use proprietary means of storing files, resulting in disks that are readable only by the software that created them. UDF-compliant packet-writing software (such as DirectCD, from Adaptec) will be available soon, and several CD-R drives (including the Philips EasyWriter and the HP SureStore 6020es) already contain firmware support for UDF.

IT'S THE SOFTWARE, STUPID

There's a very good reason why Easy-CD Pro and CD Creator rule the entry-level CD-R software market: Their developers correctly gauged the changing nature of the CD-R marketplace and made the products easier to use by restricting options, while hiding sophisticated functions beneath a simple surface.

For all its promise, CD-R has always been somewhat recalcitrant. You needed

Our Contributors: BRUCE BROWN, JOHN R. QUAIN, and WINN L. ROSCH are contributing editors of *PC Magazine*. JONATHAN HILL and JAMES KARNEY are frequent contributors to *PC Magazine*. JAMIE M. BSALES was the editor in charge of this story, and JEFF MACE was the project leader.

NOT EVERYONE CAN READ THIS.

!Grábelo en Disco Compacto!

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МОЖНО ПЕРЕВЕСТИ НА КОМПАКТНЫЙ ДИСК

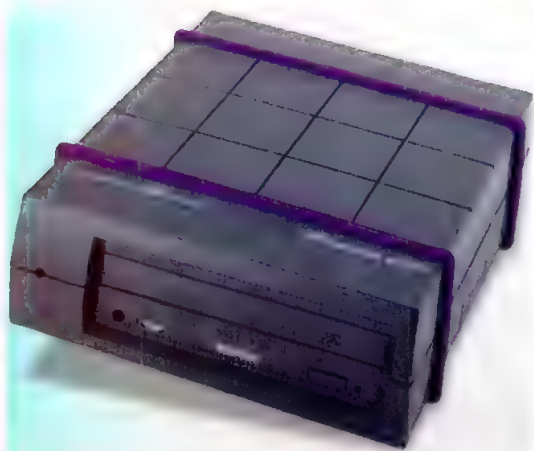
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→ 00 00 00 000000 0000

BUT EVERYONE CAN READ THIS.



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Pinnacle Micro's RCD 4x4 lets you distribute files in a format almost anyone can use. And at **under \$9*** for a 650mb/74 minute disk, it's a great way to store and distribute databases, graphics and all your files. The RCD 4x4 plays and records CDs at 4X speed. You can make a CD – up to 650mb – in about 15 minutes. Unlike other CD-R systems, the 4x4 has a 1MB buffer for smooth CD burn.

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to be read as if you'd created them in one.

Blue Book, also known as *Enhanced CD* (as well as *CD-Extra* and *CD-Plus*), describes an updated form of the mixed-mode disk based on the CD-ROM/XA format. Although you can play the audio portion of a Blue Book CD in any audio CD player, a Windows 95-based CD-ROM drive can also access the data (located in the last track), providing added value in the form of playlists, lyric sheets, or even links to Web sites.

CD-R TASK LIST

Virtually all current CD-ROM readers can read multisession CDs based on Orange Book. This capability has driven the huge expansion in CD-R sales over the past two years, because it provides a cost-effective means of recording data for archiving or sharing.

In addition, unlike nearly any other

computer component, CD-R has a direct link to the general consumer market: It enables the creation of disks you can play in any audio CD player. With the right hardware and software, you can build a customized CD audio disk from prerecorded disks.

Creating an audio CD is really a specialized form of multimedia authoring. As we detailed in our story on multimedia authoring tools ("Create Your Own CD," April 9, 1996), you can create sophisticated multimedia titles using an authoring tool such as Aimtech's IconAuthor (one of our Editors' Choices for that story) and publish it yourself on CD-ROM. Many business users may want to consider this option for creating presentations, training disks, or sales and marketing materials that combine sound, digital images, and video.

Though CD-R is just making inroads into the mainstream PC arena, already the

next generation of CD recorders is ready for market. Compact disk-rewritable (or CD-RW, also called compact disk-erasable, or CD-E) drives will let you overwrite disks to update data or to reuse the media. They will record on both CD-R and CD-RW media and read all CD-ROM formats.

But before you jump on the CD-RW bandwagon, think carefully about how much you need rewritable disks. CD-RW writers will cost significantly more than equivalent CD-R devices, and CD-RW disks will cost roughly four times as much as CD-R media for the foreseeable future.

CD-R has finally begun to reach its potential. The advent of UDF-based packet writing means true drive letter access, and lower prices put the drives within reach. Improved IDE support is the final hurdle to making CD-R technology a good fit for everyone.

Software: The Other Half of the Equation

By Jan Ozer

As the reviews illustrate, CD-R is largely a software story. Write speed and firmware aside, a drive's performance is largely affected by the premastering software it is wedded to. Adaptec owns the lion's share of the bundled software market, with Easy-CD Pro and the recently acquired Corel CD Creator. With the exception of the JVC and Microboards units, all the drives we tested included one or the other.

MASTER OF THE MARKET

Easy-CD Pro 1.2 (\$349; 408-925-8600; www.adaptec.com) lets you back up files, as well as copy Red Book audio files or previously mastered CD-ROM data without first creating a disk image file, (if the source CD-ROM is on the SCSI chain). It also lets you compile selections from various CD-ROMs.

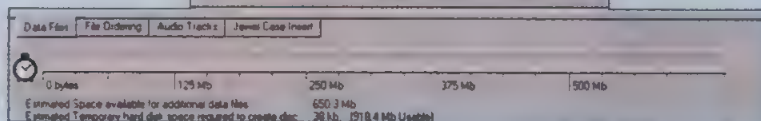
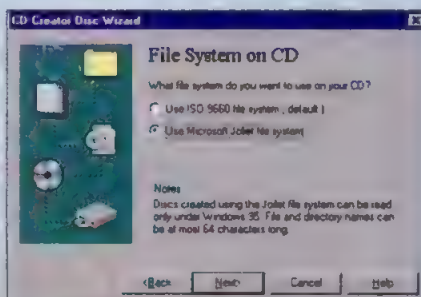
All in all, Easy-CD Pro is easy to learn and use, though the current version lacks a wizard to walk you through the steps. While the software lets you set the order of root-directory files, the ISO requirements force

it to alphabetize the files within each directory, diluting the benefit.

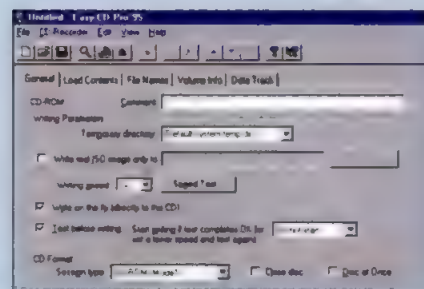
As of this writing, Adaptec was completing a beta version of Easy-CD Pro 2.0, expected to ship in April. The new version brings to Easy-CD Pro all of CD Creator's features, adding wizards, a jewel-case designer and label-creation templates, enhanced Red Book audio capabilities, and Windows NT 4.0 support.

THE COREL TOUCH

With **CD Creator 2.0** (\$249; 408-925-8600; www.adaptec.com) Corel debuted two



CD Creator 2.0 has a wizard but can't support both ISO-9660 and Joliet extensions.



Though version 1.2 lacks a wizard, Easy-CD Pro's five-tabbed interface is easy to follow.

sorely needed features: wizards and a jewel-case designer. The program lets you create Video CD titles and duplicate an audio CD or a CD-ROM without creating a disk file (again, assuming the source drive is on the SCSI chain).

CD Creator has its share of warts, though. It offers little control over file placement on the CD-ROM, and no support for hybrid CD-ROM creation. And it's the only program here that cannot create a disk containing both the Joliet extensions for long file names under Windows 95 and an ISO-9660 file system, which means if

Working with the Bundles

There's a CD-R package to suit every need and budget

One of the pricier CD-R packages we tested was the **Consan RO-1420C** (\$1,099 list). Made by Ricoh and distributed here by Consan, the drive has some unique characteristics, such as a vertical mount option. But the software package severely limits its capabilities. In addition, at the time of this writing, Ricoh has not yet completed the firmware to allow the drive to act as a backup device using incremental packet writing. Although packet writing is poised to become the new hot ticket in CD-R drives, only 5 out of the 16 drives we tested support it.

The external 2X-write/4X-read drive we tested included an Adaptec AHA-

2940UW SCSI adapter and Easy-CD Pro mastering software. Installation could not have gone more smoothly. The inherent limitations of the Easy-CD Pro version 1.x Windows software, however, prevented the drive from passing some of our CD-R torture tests. Although its write speed is comparable to other 2X drives, there is no Photo CD recording option. In addition, you must have a SCSI CD-ROM player in order to copy files from a CD-ROM.

Version 2.0 of the Easy-CD Pro software should eliminate this problem, though. This is a solid drive, so you should hold out for the bundle with the newer software package. (Consan Storage Solutions, Eden

Prairie, MN; 800-229-3475; www.consan.com. Circle 461 on reader service card.)

Known for turnkey multimedia systems, Creative Labs comes as near as we have seen to producing an instant CD recorder with its **Blaster CD-R 4210** (\$700 street). The kit is minimal, including only the SCSI adapter and two blank disks. Setup was painless, and we even made usable disks on the first try.

The caddyless 2X-write/4X-read Matsushita (the parent company of Panasonic) drive showed no bad habits. Performance on our On-the-Fly Burn test was on a par with other 2X drives.

In testing, the combination of the Easy-CD software and our IDE test-bed proved troublesome, preventing us from completing even mundane chores. We had to use SCSI hard disk and CD-ROM subsystems to complete disk duplication chores and on-the-fly burns of large files.

you create a disk that supports long filenames, only Windows 95 can read it.

Adaptec plans to merge Easy-CD Pro with CD Creator to create Easy-CD Creator, expected to ship later this year. Not only will the product include most mainstream CD-R functions, but a *digital DJ* feature will let users create audio CDs from tape and LPs as well.

GETTING INTO GEAR

Although Elektroson's **GEAR** (\$199; 408-371-4800; www.elektroson.com) offers most of the pre-mastering basics, CD-R-savvy users will find it obtuse and somewhat frustrating to use. There are no wizards and the Help feature is cryptic. GEAR creates CD-ROMs in CD-ROM XA, mixed mode, and multisession formats, and while it handles Windows 95 long filenames properly, documentation on the subject is virtually nonexistent. The program can't create Video CD applications, nor does it include an audio editor or a jewel-case designer.

GEAR's primary strength is a batch function that automates routine projects. Though the program supports Windows

95, Windows NT 3.1, Macintosh, OS/2, and Unix, the Windows versions can't create hybrid disks that support the Mac or Unix directory structures.

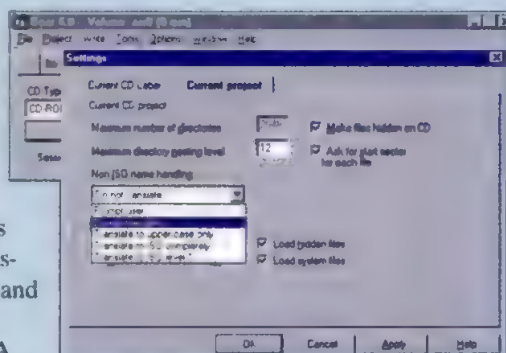
CROSSING OVER

We looked at two products for advanced functions such as cross-plat-

form development: CeQuadrat USA's **WinOnCD** (\$299; 800-330-6734; www.cequadrat.com) and Creative Digital Research's **CDR Publisher HyCD** (\$495; 408-255-0999; www.cdr1.com). ISO-9660 is the CD-ROM world's standard file format, readable by DOS, Windows, Mac, and Unix machines. Unfortunately, ISO-9660 was designed for the lowest common denominator—DOS and Windows (which limits filenames to the 8.3 format). A *hybrid disk* is a multiplatform disk that contains a separate partition for each platform. The ISO file system resides in the DOS directory, and HFS data in the Mac directory.

A *shared hybrid disk* creates two or more directory structures that share common data files. WinOnCD can create a Windows 3.x/Windows 95/Mac shared hybrid CD-ROM, and also provide advanced audio editing and Video CD creation capabilities.

The undisputed cross-platform king is CDR Publisher HyCD, which can create four-way hybrid disks using separate file structures for Windows 3.x, Windows 95, Mac, and Unix, all sharing the same files. The program suffers, though, from a dated look and some tough-to-forgive interface choices. But CDR Publisher HyCD gets the job done—and equally important—it's the only product that offers four-way hybrid disk creation capabilities.



GEAR offers all the pre-mastering basics, but its Settings interface is far from intuitive.

form development: CeQuadrat USA's **WinOnCD** (\$299; 800-330-6734; www.cequadrat.com) and Creative Digital Research's **CDR Publisher HyCD** (\$495; 408-255-0999; www.cdr1.com).

To understand cross-platform development a bit of background is in order.

David.



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an additional battery. It's Toshiba's ultimate in flexibility and usability from the award-winning Portégé line. For more information, visit the Toshiba website at <http://computers.toshiba.com>, or for a dealer near you, call 1-800-457-7777.

In Touch with Tomorrow
TOSHIBA

CIRCLE 378 ON READER SERVICE CARD

However, if your needs are modest, there is no reason to look askance at this drive. (Creative Labs Inc., Milpitas, CA; 800-998-5227; www.creativelabs.com. Circle 462 on reader service card.)

Hewlett-Packard started the low-priced CD-R war last year with its sub-\$1,000 bundle. While the new **HP SureStore CD-Writer 6020es** (internal version, \$780 street; external, \$940) is not a price leader this time around, the Philips-equipped 2X-

write/6X-read drive is a solid value.

The HP SureStore does not include a SCSI adapter card but comes with Easy-CD Pro version 1.2, one blank disk, and assorted software applets. Chief among them is Alchemy Personal for Hewlett Packard 4.0, which creates searchable databases of filenames for archiving and retrieving stored files. The HP SureStore does not yet support packet writing.

We tested the drive using an Adaptec

AHA-2940U SCSI-II card. Like the other Easy-CD Pro-equipped systems, the drive could not complete the Large On-the-Fly Recording test; however, it fared well on our On-the-Fly Burn test. For general-purpose applications, this updated bundle is a fine performer. (Hewlett-Packard Co., Palo Alto, CA; 800-810-0134; www.hp.com/go/storage_support. Circle 463 on reader service card.)

The **JVC Personal Archiver Plus** (inter-

PERFORMANCE TESTS

CD-R Drives



Compact disk-recordable bundles are cheaper now but still not foolproof. Users copying CD-ROM disks or large numbers of small files may encounter problems. For best results, you need SCSI rather than IDE hard disk and CD-ROM drive subsystems.

What the Numbers Mean

In last year's roundup of CD-R drives ("Create Your Own CD," April 9, 1996), we tested the products on SCSI-based test-beds. This year, taking into account the fact that most PCs come configured with PIO4 (programmed input/output) IDE hard disks and IDE CD-ROM drives, we tested under IDE.

But testing proved that to get optimal performance out of today's CD-R drives and mastering software, SCSI-based drives are a must. Under IDE, nearly every drive failed several of our torture tests; the same drives passed similar tests last year under SCSI.

The JVC Personal Archiver Plus, which uses proprietary mastering software, deliv-

ered the best performance of the group,acing the greatest number of torture tests. It was one of only four drives to pass the Large On-the-Fly Recording test, which incorporates a complex ISO 9660-compliant directory structure containing 17,000 files, most under 1K. The Philips EasyWriter 2600, the Olympus CD-R2X4, and the Sony Spressa CSP-9411S (all of which use Corel CD Creator 95 mastering software) also held up well. The remaining drives were able to complete the On-the-Fly Burn test only. All but one of these used Incat's Easy-CD Pro 1.2.

Mastering software has a solid impact on drive performance. CD Creator, for example, has some features that Easy-CD Pro sorely lacks. When it encounters a potential problem, such as running out of scratch space on the hard disk, CD Creator closes the track and pauses, and then opens a new one and resumes preparing files. Although data from CDs burned this way can be read only by CD-ROM XA-compatible drives,

WRITE TEST

On-the-Fly Burn

Minutes seconds

Bold type denotes first place.

Conson RO-1420C	9:08
Creative Labs Blaster CD-R 4210	8:32
HP SureStore CD-Writer 6020es	8:48
JVC Personal Archiver Plus	9:42
Microboards PlayWrite 4000	4:51
MicroNet Master CD Plus 4x4 CD-R	5:01
Olympus CD-R2X4	8:38
Optima Diskovery 650CDR	8:54
Philips EasyWriter	9:02
Pinnacle Micro RCD 4X4	5:15
Plasmon CDR4240e-S1 Afterburner	10:00
Plexstor Plexwriter 2/4	8:20
Smart and Friendly CD-R 2004/Pro	8:43
Smart and Friendly CD-R 4000/Pro	5:04
Sony Spressa CSP-9411S	8:40

◀ BETTER

CD-R TORTURE TESTS

Large On-the-Fly Recording

Create Enhanced CD/CD Plus

Create Multisession Photo CD

Copy Red Book Audio

Copy CD

Fail	Fail	Fail	Fail	Fail
Fail	Pass	Pass	Fail	Fail
Fail	Pass	Pass	Pass	Fail
Pass	Fail	Pass	Fail	Pass
Fail	Pass	Pass	Fail	Fail
Fail	Fail	Fail	Fail	Fail
Pass	Fail	Pass	Fail	Fail
Fail	Fail	Fail	Fail	Fail
Pass	Fail	Pass	Fail	Fail
Fail	Pass	Pass	Fail	Fail
Fail	Pass	Pass	Fail	Fail
Fail	Fail	Fail	Fail	Fail
Fail	Fail	Fail	Fail	Fail
Fail	Fail	Fail	Fail	Fail
Pass	Fail	Pass	Fail	Fail

nal version, \$500 street; external, \$600) is stable, capable, and easy to use. We found its 2X-write/4X-read drive to be well designed and a good choice for making backups or creating multimedia CDs. It passed more than half of our torture tests without leading us astray through countless options and menus.

JVC was one of the first manufacturers of CD-R drives, and the experience shows. The drive comes with an Adaptec

AHA-1510A SCSI adapter as well as JVC's own Personal Archiver, software that we found easy to master. JVC includes a set of CD-R extensions that let you use the drive as another storage device and do simple incremental recordings to it without any fuss. Installation was relatively straightforward, with no major glitches.

Although the JVC Personal Archiver Plus placed near the bottom of the pack

in terms of speed, it managed to complete more tasks than other drives, such as recording multisession Photo CDs and CD audio tracks (although the audio tracks must first be copied to the hard disk). Overall, this is a well-behaved drive and an outstanding value. (JVC Information Products Co. of America, Irvine, CA; 714-816-6500; www.jvcinfo.com. Circle 464 on reader service card.)

the majority of drives today are of this type.

Our On-the-Fly Burn test used a nested directory structure containing assorted files totaling 90MB. Because some of the files were several megabytes in size, the test closely resembled a typical archiving scenario (more so than our Large On-the-Fly Recording test). Four products passed muster at 4X: the Microboards PlayWrite 4000, the MicroNet Master CD Plus 4x4 CD-R, the Pinnacle Micro RCD 4X4, and the Smart and Friendly CD-R 4000/Pro. The remaining drives accomplished the task with a 2X burn.

To evaluate the drives' performance as CD-ROM readers, we ran our CD-ROM WinMark 97 tests. All the drives that read at 4X scored below 441, the score of the 4X reference drive used in our previous roundup of 10X and 12X CD-ROM drives ("21st-Century Storage," January 21, 1997). But the bulk of these CD-R drives read at 2X and performed in the unimpressive middle-to-high 200s.

The HP SureStore CD-Writer 6020es, the

Olympus CD-R2X4 (which uses a newer version of Easy-CD Pro), and the Philips Easy Writer 2600 were able to pass the Copy Red Book Audio test. This was due to software enhancements that let each CD-R drive function as its own CD reader in lieu of a SCSI CD-ROM drive. Though this lets the CD-R drive squeak past the IDE problem, the audio must first be written to the hard disk, which slows down the read time considerably.

It is the job of the mastering software to send a steady stream of data to a drive's buffer. Any interruption in this flow will result in a failure, or a buffer underrun. Most software lets you test a system for its highest writable speed. If the software detects a possible throughput problem, it suggests that you lower the recording speed.

Because our test-bed was IDE-based, some 4X drives turned in slower-than-expected recording timings and failed many of our torture tests. After the blowout, we ran a sampling of the drives through random tests using a SCSI hard disk with a rotational speed of 7,200 rpm and a SCSI CD-ROM drive. Not surprisingly, the CD-R units that failed under IDE passed under SCSI.

The hardware problems we encountered under our EIDE test-bed system and its failure to work well with the SCSI CD-R drives were a bit of a surprise to us this year. We expected the new vintage of 5,400-rpm EIDE drives operating with Mode 4 (16.6MB/sec) transfer rates from their on-board buffers to work properly in most tests. Given the predominance of EIDE drives in mainstream PCs, we would expect no less than a high success rate in creating CDs with the new crop of CD-R subsystems that target the mainstream market. Our Micron Pentium 200 EIDE drive was configured in a programmed I/O transfer mode by default, so we acquired a bus-mastering driver for the Intel 82371SB PCI/IDE controller (on the motherboard) from Micron. After enabling EIDE bus mastering under Windows 95, our Large On-the-Fly Recording test still failed. We feel most comfortable recommending 7,200-rpm SCSI hard drives (or a 5,400-rpm

AV-certified drive) for the best performance and success rate with various burn scenarios.

Adaptec emphasizes that the upcoming merging of Easy-CD Pro and Corel CD Creator (both recently acquired by Adaptec) into a hybrid mastering package will help ease the problem. But Adaptec, a SCSI-only company whose primary business is making SCSI adapter cards, might not be so quick to develop solutions that benefit IDE drives.

All the drives, with the exception of the JVC Personal Archiver Plus, failed our Copy CD test. Because the mastering software was unable to recognize our IDE CD-ROM drives as the source, the test required us to make a sector-by-sector copy (similar to DOS's Diskcopy). Though experimentation, though, we found it worked by using either the CD-R or the host CD-ROM drive as a reader and by copying the files to the hard disk before making the copy. To receive a passing grade for the Create Multisession Photo CD test, a drive's mastering software needed to support a feature called "Create Multisession Photo CD."

How We Tested

We used 200-MHz Micron Millennia Pentium systems, each configured with 32MB of EDO RAM and a 512K L2 cache. Each employed a Diamond Stealth 3D 2000 graphics card and an Adaptec AHA-2940 Ultra PCI SCSI controller card using EZ-SCSI 4.0 software and drivers. If the product shipped with its own SCSI controller, we used it instead. The sound subsystem was motherboard-based. Each system included a Proteon 1392plus Token-Ring network interface card, a WD 2.1GB (Caviar 32100) IDE drive, a Hitachi 8X IDE CD-ROM drive using the motherboard's secondary IDE channel running in PIO4 mode, and a MAG InnoVision MXP17F 17-inch monitor.

For our Large On-the-Fly Recording test, we used files supplied by Walnut Creek Software of Concord, California. For our Create Enhanced CD/CD Plus test, we used raw audio PCM files provided by Ash Pahwa, author of *The CD-ROM Bible*.

READ TEST

Packet Writing	CD-ROM WinMark 97 Thousands of Bps
No	292
No	421
No	415
Yes	296
No	266
No	265
No	231
No	275
Yes	420
No	411
No	422
No	283
Yes	235
Yes	267
Yes	239

BETTER ►

SUMMARY OF FEATURES

CD-Recordable Drives

■ YES ■ NO

In alphabetical order by company

	Conson Storage Solutions Conson RD-1420C	Creative Labs Inc. Blastor CD-R 4210	Hewlett-Packard Co. HP SureStore CD-Writer 6020es	JVC Information Products Co. of America JVC Personal Archiver Plus	Microboards Technology Inc. PlayWrite 4000	MicroNet Tech Inc. Master CD Plus 4x4 CD-R	Olympus America Inc. Olympus CD-R2X4	Optima Technology Corp. DisKovery 650CDR
List/street price cited for internal unit	\$1,099.00, N/A	N/A, \$700	N/A, \$780	N/A, \$500	\$1,050.00, N/A	N/A	N/A, \$500	N/A
List/street price cited for external unit	\$1,099.00, N/A	N/A	N/A, \$940	N/A, \$600	\$1,095.00, N/A	\$1,049.00, \$1,000	N/A, \$650	\$695.00, \$650
Mechanism manufacturer	Ricoh	MKE	Philips	JVC	Yamaha	Yamaha	Olympus	Sony
CD-ROM write/read speed	2X, 4X	2X, 4X	2X, 6X	2X, 4X	4X, 4X	4X, 4X	2X, 4X	2X, 4X
Buffer size (write/read)	2MB, 2MB	1MB, 256K	1MB, 1MB	1MB, 1MB	512K, 512K	512K, 512K	1MB, 1MB	1MB, 1MB
Interfaces supported:								
IDE	■	■	■	■	■	■	■	■
SCSI/SCSI-2	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Ultra-SCSI/Proprietary SCSI	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Parallel port	■	■	■	■	■	■	■	■
Software								
Premastering package included	Easy-CD Pro 1.2	Easy-CD Pro 1.2	Easy-CD Pro 1.2	JVC Personal Archiver	GEAR Multi/OS	Easy-CD Pro 1.2	CD Creator 2.0	Easy-CD Pro 1.2
Software analyzes PC configuration	■	■	■	■	■	■	■	■
Disk-at-once/track-at-once recording	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Preview before committing to disk	■	■	■	■	■	■	■	■
Formats supported by premastering package:								
Yellow Book/Red Book Audio	■ ■	■ ■	■ ■	■	■ ■	■ ■	■ ■	■ ■
CD-ROM XA (Mode 2, Form 1)	■	■	■	■	■	■	■	■
CD-ROM XA (Mode 2, Form 2)	■	■	■	■	■	■	■	■
MultiSession (Orange Book)	■	■	■	■	■	■	■	■
CD-I/VideoCD (White Book)	■	■	■	■	■	■	■	■
Enhanced CD (CD-Plus)/PhotoCD	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Backup software included	None	Easy-CD Backup	Easy-CD Backup	None	None	None	None	None
Other software included	EZ-SCSI Lite	EZ-SCSI Lite	IMR's Alchemy Personal, Jewel Case Creator, Mixed Mode and CD-Extra	EZ-SCSI 4.0, JVC CD-R Extensions, Transoft SCSI Director	None	EZ-SCSI Lite, SCSI Select	None	EZ-SCSI Lite
Supports incremental packet writing	■	■	■	■	■	■	■	■
Media and Support								
Number of blank CDs included	None	2	1	1	2	1	1	2
Toll-free technical support	■	■	■	■	■	■	■	■
Technical-support hours (eastern time)	9:00-6:00 M-F	7:00 A.M.-11:00 P.M. 7 days	5:30 A.M.-7:00 P.M. M-F	12:00 noon-8:00 P.M. M-F	24 hours, 7 days	24 hours, 7 days	9:00-8:00 M-F	8:00-5:00 M-F
Web site	www.conson.com	www.creative-labs.com	www.hp.com	www.jvcinfo.com	www.microboards.com	www.micronet.com	www.olympus.com	www.optimatech.com

N/A—Not applicable: The product does not have this feature.

If speed is what you need, then consider the Microboards **PlayWrite 4000** (\$1,095 list). This external 4X-write/4X-read model, based on a Yamaha drive mecha-

nism, landed the fastest time on our On-the-Fly Burn test. Such performance does not come cheap, but for business and multimedia pros who do more than occasional CD creation, the savings in time will justify the extra cost.

The drive we tested included a PCI AdvanSCSI ABP940 SCSI controller card and Elektroson's GEAR 4.0 recording software. The drive can do incremental packet writing, but you will need to get the appropriate software drivers, available free from Elektroson.

Although the PlayWrite 4000 performed like a champ on our performance tests, the GEAR software continually hampered us. The PlayWrite offers many

options serious CD-R users desire, such as buffer-size adjustment, but wading through the various menus and settings to find them is challenging, to say the least. The bundle could not complete some of our torture tests on our IDE test-bed. If you can afford the speed of the PlayWrite 4000 but do not want to wrestle with the GEAR software, Microboards also offers the same model with CD Creator software at no extra charge. (Microboards Technology Inc., Chanhassen, MN; 800-646-8881; www.microboards.com. **Circle 465 on reader service card.**)

Well-known for bundling optical technology for network use, MicroNet offers another variation on the theme with its



A solid value, HP's SureStore CD-Writer 6020es held up well in torture testing.

HARDWARE

CD-R Drives

Philips Professional Solutions EasyWriter	Pinnacle Micro Inc. Pinnacle Micro RCD 4X4	Plasmon Data Inc. Plasmon CDR4240e-S1 Afterburner	Plextor Corp. Plextorwriter 2/4	Smart and Friendly Smart and Friendly CD-R 2004/Pro	Smart and Friendly Smart and Friendly CD-R 4000/Pro	Sony Electronics Inc. Spressa CSP-9411S
\$599.00, N/A \$699.00, N/A Philips	\$899.00, N/A \$999.00, N/A TEAC	\$599.00, N/A \$699.00, N/A Matsushita	\$889.00, \$800 N/A Plextor	\$399.00, N/A \$499.00, N/A Smart and Friendly, Sony	\$899.00, N/A \$999.00, N/A Yamaha	\$799.99, N/A \$949.99, N/A Sony
2X, 6X 1MB, 1MB	4X, 4X 1MB, 1MB	2X, 4X 1MB, 1MB	2X, 4X 512K, 512K	2X, 4X 1MB, 1MB	4X, 4X 512K, 512K	2X, 4X 1MB, 1MB
■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■
CD Creator 2.0	Easy-CD Pro 1.2	Easy-CD Pro 1.2	Easy-CD Pro 1.2	Easy-CD Pro 1.2	Easy-CD Pro MM, Easy-CD Pro 95	CD Creator 2.0
■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■	■ ■ ■ ■
■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■
Seagate Backup None	Disc Archive 95 RCD Archive (PC), RCD Backup (Mac)	Easy-CD Backup None	Easy-CD Backup Plextor Manager	Easy-CD Backup CDRFS Packet Recording Software, CD Workshop, Macromedia Designer Plus	Easy-CD Backup CD Workshop, Macromedia Backstage Designer Plus	None None
■	■	■	■	■	■	■
2 ■ 9:00-8:00 M-F www.pps.philips.com	1 ■ 9:30-8:30 M-F www.pinnaclemicro.com	1 ■ 7:00-4:00 M-F www.plasmon.com	3 ■ 9:30-8:30 M-F www.plextor.com	1 ■ 10:00-8:30 M-F www.smartandfriendly.com	1 ■ 10:00-8:30 M-F www.smartandfriendly.com	5 ■ 7:00 A.M.-10:00 P.M. M-F www.sony.com/technology

PC MAGAZINE
EDITORS' CHOICE

bundles able to complete our Large On-the-Fly Recording test, though in an IDE configuration we had to drop back to 1X record speed (a full SCSI test-bed let us complete the task at 2X).

CD Creator did prevent us from producing either White Book CD-I or a proper Enhanced CD. A more robust software package would extend this drive's capability. Overall, Olympus has produced a solid, affordable drive for general-purpose backup and CD creation. (Olympus America Inc., Melville, NY; 800-347-4027;



www.olympus.com. Circle 467 on reader service card.)

Optima's **DisKovery 650CDR** (\$650 street) is a 2X-write/4X-read Sony mechanism with a 1MB buffer. The drive includes an Adaptec AHA-1540CP SCSI host adapter, a disk caddy, two blank CDs, and Easy-CD Pro version 1.2 software.

As with many other drives in this roundup, a combination of IDE/SCSI issues, as well as software limitations, produced less than optimal test results. The drive landed in the middle of the pack on our On-the-Fly Burn test but failed our torture tests when hooked to an IDE test-bed. We had no trouble working with or copying material from audio CD and aluminum CD-ROM originals under a full SCSI system. The combination of the fine Sony mechanism and more robust software would make this bundle a serious contender. (Optima Technology Corp., Irvine, CA; 800-411-4237; www.optimatech.com. Circle 468 on reader service card.)

The Philips **EasyWriter** (internal version, \$599 list; external, \$699) package gets good marks for overall design and an above-average software bundle. Well suited for general CD-R tasks (especially backup), this 2X-write/6X-read drive

Master CD Plus 4x4 CD-R (\$1,049 list). Mounted on a custom external case, the package features a Yamaha 4X-write/4X-read CD-R drive with a 512K buffer, and it includes an Adaptec AHA-1510 SCSI host adapter and Easy-CD Pro software. The unit can be fast—if you have the right hardware to support it.

Setting up the Master CD was simple. In testing, though, the drive demonstrated the inherent limitations we found using the Easy-CD Pro software and an IDE-based host system for CD creation. While it turned in the second-fastest time on our On-the-Fly Burn test, the software/firmware combination hamstringing it on our suite of CD-R torture tests when mar-

ried to IDE hard drive and CD-ROM subsystems. Attaching to a full SCSI system produced better results. (MicroNet Technology Inc., Irvine, CA; 714-453-6100; www.micronet.com. Circle 466 on reader service card.)

The **Olympus CD-R2X4** (internal version, \$500 street; external, \$650) is a 2X-write/4X-read drive aimed at mainstream users willing to provide their own SCSI cards. The drive mechanism is also made by Olympus, and the package includes a SCSI cable, CD Creator mastering software, and one blank disk.

The CD-R2X4 was one of the fastest 2X recorders on our On-the-Fly Burn test. This Olympus was also one of the few

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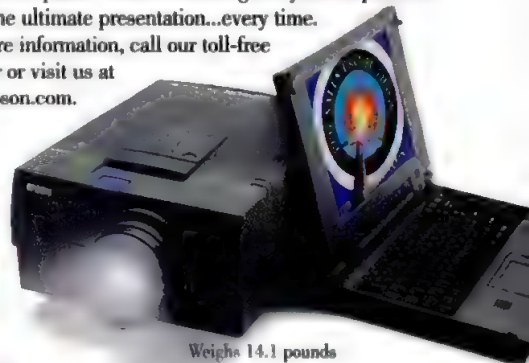
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CIRCLE 005 ON READER SERVICE CARD



points to where mainstream CD-R bundles are going. The external unit we tested ships with an Adaptec AHA-1535 SCSI adapter and two blank disks. The software includes OEM copies of Adaptec's EZ-SCSI 4.0, CD Creator 2.01, and the new Seagate Backup Exec (still in beta during our testing), which enables packet writing.

Installing the drive and the software was problem-free. The unit performed respectably on our On-the-Fly Burn test. And while most drives failed our Large On-the-Fly Recording test, the Easy-Writer performed the chore at top speed, thanks in part to the new Seagate backup software, one of the first to make use of packet-writing technology. The software lets you use your CD-R drive exactly as you would use a tape backup drive.

The EasyWriter's ability to handle large IDE-to-SCSI transfers, coupled with its backup capability, makes it one of the more appealing options on the market today. (Philips Professional Solutions, San Jose, CA; 800-235-7373; www.pps.philips.com. Circle 469 on reader service card.)

The **Pinnacle Micro RCD 4X4** (internal version, \$899 list; external, \$999) is a complete CD-R package with no surprises. Based on a Teac mechanism, this 4X-write/4X-read drive is aimed at power users who need data backup and archiving, video and audio production, and data distribution applications. While it requires a fast host system and a SCSI source CD-ROM drive for some functions (as do other drives using the majority of mastering software we saw), the RCD 4X4 tested admirably and is easy to install and use.

The full RCD 4X4 bundle includes an Adaptec SCSI-II adapter, two blank CDs, Easy-CD Pro, and Disc Archive 95 and

RCD Archive backup applets. Setup is a no-brainer: We simply plugged in and let Windows 95 recognize both it and the Pinnacle drive. The RCD 4X4 completed the On-the Fly Burn test in good time, but, like other Easy-CD Pro bundles, it failed to complete several of our torture tests. You can do a lot with an RCD 4X4 and do it quickly; just be sure to use a robust SCSI host system. (Pinnacle Micro Inc., Irvine, CA; 800-553-7070; www.pinnaclemicro.com. Circle 470 on reader service card.)

Plasmon Data targets its **Plasmon Afterburner** (internal version, \$599 list; external, \$699) for general corporate use. The 2X-write/4X-read Matsushita mechanism comes bundled with a SCSI cable, Easy-CD Pro software, and one blank CD. The software lets you make any standard form of CD from menus and adds a wizard for more complex operations.

The unit delivered the slowest On-the-Fly Burn scores. And like the other Easy-CD bundles, it failed to complete some of our torture tests when hooked to an IDE system; installing a SCSI CD-ROM let it copy audio CD tracks and production CDs, though only at 1X.

An affordable but unremarkable package, the Plasmon Afterburner shows its best side only when accompanied by a full SCSI system. (Plasmon Data Inc., Eden Prairie, MN; 800-451-6845; www.plasmon.com. Circle 471 on reader service card.)

Though not the speed-leader in CD-R drives that it is for CD players, Plextor delivers a solid 2X-write/4X-read package with its **Plexwriter 2/4** (\$800 street). For the price, you get Plextor's own drive, an Adaptec AHA-2930 SCSI host adapter, Easy-CD Pro, and one blank CD. The bare drive is available for \$700, which might be a better bet until the next version of Easy-CD Pro remedies the problems we experienced.

Installation and operation are quick and intuitive. The host adapter handles all hardware issues automatically. Even inserting a disk is a simple one-handed job thanks to a clever drive-door design that lets you slide a caddy straight in. Unfortunately, the drive automatically pops the caddy out at the end of a session, a common but bothersome feature, especially when it occurs between a prewrite test and actual writing.



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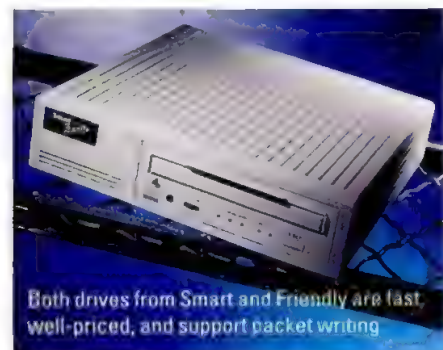
HARDWARE

CD-R Drives

The Plexwriter was one of the quicker 2X recorders on our On-the-Fly Burn test, though we need not reiterate the Easy-CD/IDE litany again. With a more robust mastering package, the rugged Plexwriter could be a contender. (Plextor Corp., Santa Clara, CA; 800-475-3986; www.plextor.com. *Circle 472 on reader service card.*)

We asked last year's Editors' Choice CD-R drives back this year to see how they would stack up against the current competition. Smart and Friendly offers a Sony-equipped 2X-write/4X-read and a Yamaha 4X/4X model, both of which include identical hardware and software accessories. This time, neither the **Smart and Friendly CD-R 2004/Pro** (internal version, \$399 list; external, \$499) nor the **Smart and Friendly CD-R 4000/Pro** (internal version, \$899 list; external, \$999) won us over in terms of flexibility (thanks again to the Easy-CD/IDE tangle). These products do support incremental packet writing and should prove good bets for casual backup or more demanding CD authoring when married to the right software and host system.

Each drive comes with an AVA-1502E SCSI adapter and a raft of software. For users who want to create their own Web pages, for example, the bundle includes Macromedia's Backstage Designer Plus. The mastering software is Easy-CD Pro 1.2, adequate for most tasks if you have a SCSI system. Adaptec's EZ-SCSI Lite 4.0, Easy-CD Backup for Windows 3.1, and CD Workshop for Windows 3.1 round out the offerings. Our only setup complaint was the need to reset a jumper switch to prevent the SCSI adapters from conflicting with our test systems' sound boards. Otherwise, experienced users should find installation and use relatively painless.



Both drives from Smart and Friendly are fast, well-priced, and support packet writing

In flat-out speed tests, both drives were fast and stood up well in their respective categories. Smart and Friendly's prices are hard to beat and may attract bargain hunters looking for a solid backup and CD creation solutions. (Smart and Friendly, Chatsworth, CA; 800-366-6001; www.smartandfriendly.com. *Circle 473 on reader service card.*)

Sony has quickly become a major



Our Editors' Choice, the Sony Spresa, boasts a large buffer and packet-writing support.

CD-R drive manufacturer, and the **Spresa CSP-9411S** (internal version, \$799.99 list; external, \$949.99) provides a ready demonstration of the reasons behind the company's near-instant success.

This external 2X/4X drive includes five blank disks and CD Creator 2.0 mastering software (but no SCSI controller). The Spresa was a breeze to set up, and its generous 1MB buffer (and CD Creator's cyclical buffering scheme) means near-infallible on-the-fly recording. The drive is also well suited to advanced tasks such as audio extraction and VideoCD production.

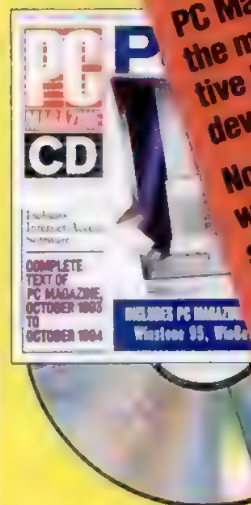
The drive performed on a par with other 2X writers on our On-the-Fly Burn test, and it was able to complete our Large On-the-Fly Recording Test. It supports incremental packet writing, but it could not successfully create an Enhanced CD (the disk it produced was not readable under Windows 95, although the audio portions played fine on a standard audio CD player). Overall, this is a solid offering, versatile and easy to use. (Sony Electronics Inc., San Jose, CA; 800-352-7669; www.sel.sony.com. *Circle 474 on reader service card.*) □

Reviews by Bruce Brown, Jonathan Hill, James Karney, John R. Quain, and Winn L. Rosch

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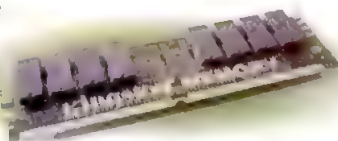
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Adapted for RAD

Powerful visual paradigms from the world of rapid applications development bring streamlined speed to C++ development.

By Douglas Boling

C++ IS A COMPLEX LANGUAGE, ONE THAT CAN HUMBLE THE MOST DEDICATED PROGRAMMER. MANY MAY USE IT, BUT FEW KNOW IT THROUGH AND THROUGH. WITH C++ DEVELOPMENT TOOLS, IT'S LONG BEEN A SIMILAR STORY. TODAY'S INTEGRATED

DEVELOPMENT ENVIRONMENTS (IDEs) ARE A FAR CRY FROM THE BARE-BONES TEXT EDITORS, COMMAND LINE COMPILERS, AND STANDALONE DEBUGGERS OF YORE, BUT IT STILL TAKES A HIGHLY TRAINED EXPERT TO USE AN IDE PRODUCTIVELY.

IN THIS REVIEW

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of RAD and C++
PRODUCTION

HIGHLIGHTS

C++ Development Tools

Visual RAD programming has been around for years, but it took Borland International's Delphi to show that RAD could be paired with a powerful language. Now, C++ tools, lead by IBM Corp.'s Visual Age for C++ and Powersoft's Optima++, are quickly adopting RAD approaches. Thanks to sophisticated code generators and powerful component models, programming increasingly becomes a matter of placing native or OLE components on a form, setting properties, and writing code to handle events. At their best, C++ RAD environ-

ments offer the productivity of tools such as Microsoft Visual Basic while keeping the low-level power of traditional C++.

Traditional approaches to C++ programming still have their place, however. Microsoft Visual C++, Symantec C++, and Watcom C/C++ retain a more traditional code-intensive development paradigm but excel at low-level system programming and debugging. The barriers to entry may be higher with these tools, but programmers who need the greatest

degree of control or who must support legacy or MFC code will still need their power.

Database programming is the meat and potatoes of many corporate shops, and C++ development systems are adding dedicated tools to address database tasks. These tools run the gamut from data-bound controls to automatic forms generation from existing schemas to remote SQL debugging. Microsoft Visual C++ and Optima++ even include developer versions of industrial-strength SQL databases.

If you're not an expert to start with, learning how to use one can feel like trying to scale a sheer cliff.

SIGNS OF HOPE

Does C++ really have to be this hard? At the time of our last roundup ("C++ Programming: Significant Development," April 11, 1995), there was no workable alternative. But over the past year, we've seen the first of a new generation of C++ tools that challenges our assumptions. Instead of further honing the existing IDE metaphor, these new tools have borrowed paradigms from visual rapid-applications-development (RAD) tools such as Microsoft Visual Basic or Powersoft's Power-

Builder. The result is a crop of hybrid development systems with the power of the C++ language but with the ease and productivity of a RAD tool.

Using a task-oriented testing script in combination with our traditional performance tests, we set out to discover whether these newer RAD-style tools could hold their own against—or possibly surpass—traditional C++ development systems. We focused on commercially available development systems that both target and run under 32-bit Windows platforms. Tools that were not shipping at press time or that have not received a major upgrade since our last story are discussed in sidebars.

We found the C++ RAD tools to be surprisingly powerful and flexible. At the same time, traditional IDE environments still offer the expert programmer a greater degree of control for low-level system programming. Our compiler performance tests turned up real differences among the products, although these are becoming increasingly less important for many projects (see the performance section for test results).

IDE CLASSIC

Ever since the days of the classic Borland Turbo Pascal, with its integrated editor, compiler, and debugger, developer tools have aimed not just to compile code but

C++ DEVELOPMENT TOOLS

How to Read the Suitability to Task Boxes

Internet client/server Tools should provide controls or class libraries that support HTTP, NNTP, FTP, and other standard Internet protocols. Tools should also be able to target NSAPI, ISAPI, and CGI server applications.

Database development We rate the power of classes or components to encapsulate database connectivity, and we assess the control you can have over the connection. Tools should help with development from existing schemas and provide broad database connectivity out of the box. Remote SQL debugging, stored procedure editing, and a powerful developer SQL database enhance the score

Enterprise development We look for strong cross-platform support and a consistent interface on all platforms. Bundled change management or version

SUITABILITY TO TASK		
Product Name	Power	Ease
Internet client/server	Excellent	Excellent
Database development	Good	Good
Enterprise development	Fair	Fair
Rapid application development	Poor	Poor
System-level programming	Excellent	Excellent
Legacy maintenance	Good	Good
Debugging	Fair	Fair

control, or at least hooks to third-party version control packages, improve the rating.

Rapid application development We look for support for ActiveX or other standard components, a strong library of native components, and easy programmatic access to properties, methods, and

events at design time through visual tools. We rate the quality of project management tools, including class browsers and object inspectors, and we assess the IDE's ease of use. The best tools can also create visual controls for reuse by inheriting from existing components.

System-level programming Tools should support embedded assembler, COM objects, shell extensions, and system message hooks; be able to create DLLs; and offer flexible exception handling

Legacy maintenance We rate the ability to work with existing code, including third-party and custom C++ libraries, MFC, and 16-bit Windows code

Debugging The best tools have full sets of flexible, low-level debugging features.

to assist the developer. This is the basic premise of the IDE. With these tools, the classic approach to application building is the standard edit, compile, debug cycle. You write source code in a text editor, compile it with the compiler, and debug it with a debugger. Bugs are fixed by editing the code, and then the process starts over. Today's C++ compilers have honed this process to a fine edge.

Editors are now language-syntax aware and use colors and fonts to highlight the keywords, comments, and variables of the program. With the profusion of source files in C++, IDEs also provide class and project browsers to help manage the different files and keep track of the functions and classes distributed among them.

Compilers can now incrementally compile only the code that has changed, and not just on a file-by-file basis but at the function level. Header files are pre-compiled, so that the header information can be processed at lightning speed. Compilers are also designed to produce code optimized for specific Intel micro-processors.

Today's debuggers use the editor window as the user interface, complete with the editor's syntax highlighting. Setting a breakpoint can be as simple as finding the line of code in the editor and hitting a function key. Complex breakpoints can be set by evaluating expressions containing program variables. Debuggers can even monitor a program's memory use and report memory leaks when the debugging session ends.

MOVING TO VISUAL TOOLS

Even with all the assistance a modern IDE provides, the Edit/Compile/Debug process remains a slow one. The visual paradigms now turning up in the latest C++ tools attempt to stand this process on its head. Instead of writing code in an editor, and then creating a dialog box in a dialog editor, the process is reversed. You begin by creating a *form* that will become a window in the program. You then popu-

Editors' Choice

- Microsoft Visual C++ 4.2 Enterprise Edition
- Optima ++ 1.5 Professional



A year ago, there wasn't much question about what a C++ tool should look like. Today, the category is in upheaval as programmers face basic changes in the way

they work. Our two Editors' Choice award winners reflect both sides of the divide that's fast appearing between traditional C++ environments and the newer RAD-oriented C++ tools coming onto the scene. Both are superb development systems that are without peer at certain tasks.

Microsoft's Visual C++ 4.2, Enterprise Edition, is a coding-intensive tool of the old school that remains unrivaled for system-level, 32-bit Windows coding. Its support for embedded assembler, powerful debugging with runtime error monitoring, and high level of ANSI C++ compatibility will appeal to purists looking for the highest degree of control. At the same time, its App and Class Wizard code generators can help you get a solid start on OLE and database applications with a variety of interface types.

Visual C++ ships with the new Microsoft Foundation Classes 4.2, the latest release of the de facto standard Windows framework. New features include beefed-up support for Internet clients and servers, as well as ActiveX control creation support. The Visual C++ compiler remains a powerful workhorse that turned in excellent performance on our tests, delivering both the fastest and smallest executables overall. Visual C++ won't be to every programmer's taste, but in the hands



of a power programmer it will take you further than any other tool here.

The radical premise of Powersoft's Optima ++ is to blend a visual RAD-style programming paradigm with the C++ language. This combination has sparked a revolution that other vendors, including Borland and Symantec, have been quick to join.

Optima ++ provides an extensible component model and visual form-design tools that let you intuitively create event handlers and manipulate properties. Under the covers, powerful code generators handle much of what used to be done by hand.

Optima++ supports ActiveX and OCX controls, and its Component Library provides some 150 prebuilt reusable components for building everything from list boxes to Web browsers.

Database programmers will be intrigued by Optima++'s inclusion of a PowerBuilder DataWindows control. The addition of a developer version of Sybase's SQL Anywhere rounds out the package as a powerful database tool. All programmers will appreciate its intuitive approach to class and project management, as well as its useful Reference and Parameter Wizards. Optima++'s only real weakness is in working with MFC and other legacy code. But if you're starting a project from scratch or can encapsulate existing code as an ActiveX, it's the most productive environment around.

late the form with prebuilt controls, typically written to support an ActiveX, OCX, SOM, or native tool interface. These controls may be bundled with the tool, come from a third-party control vendor, or be developed in house.

Once the form is laid out, you write event handlers as short blocks of code to be executed in response to events from the user or other controls. Typically, you will also set the control's design-time properties through property sheets or a comparable interface. Under the covers, the development tool generates the huge amount of code needed to support your forms and controls.

Within this basic paradigm, each tool has its own approach. Powersoft's Optima++ resembles Borland's Object Pas-

Our Contributors: DOUGLAS BOLING is a contributing editor of *PC Magazine* and the author of many *PC Magazine* utilities. RICHARD V. DRAGAN is a programmer at PC Magazine Labs and teaches C++ at Columbia University. GABRIELLE GAGNON is the systems research and development manager for the Christian Science Center in Boston. THOMAS MACE was the senior editor in charge of this story, and JAY MUNRO was the project leader.

cal-based Delphi, which in turn draws its inspiration from Microsoft Visual Basic. IBM's VisualAge for C++ takes a more Smalltalk-like approach where parts, (controls) are visually connected in the design environment by graphical lines that indicate programmatic relationships.

PICKING TOOLS FOR THE REAL WORLD

In the real world, many considerations will influence your choice of a tool, including programmer skills, application requirements, support for legacy code, and database integration.

Applications developed for the corporate environment make special demands. These are almost always produced under time pressure, often by groups of programmers. Here, the requirements for an ideal tool are a combination of ease of programming, group-programming features, and an ability to produce robust, standalone code.

The corporate environment must also take legacy code into account. The ability to recompile old source code with minimal modification can easily be an overriding consideration. If your strategic legacy code is based on a standard framework such as MFC, support for that framework is a must. Finally, corporate apps often focus on data access. Tools that support design-time connections to data sources, provide data-bound controls, support stored procedure editing, or offer remote SQL debugging will have a clear edge.

Though the long-term future clearly belongs to the visual RAD tools, we expect it to be a while before they achieve parity with the classic IDEs on all fronts. What follows will help you zero in on the most important features to help you discover what makes the best sense for you today.

Microsoft Corp.

Microsoft Visual C++

BY DOUGLAS BOLING



Microsoft Corp.'s Visual C++ 4.2, Enterprise Edition, is the power C++ programmer's best bet for hacking true system-level code. In fact, it's a hacker's paradise, with everything from embedded assembler to the latest ANSI C++ compatibility. Along with this power, though, comes the

responsibility of knowing how to use it.

Those looking for a more intuitive approach to C++ programming will find the product less accommodating. Its resource editor and syntax-highlighted editor, which used to be cutting edge among visual-language products, have grown a little long in the tooth. You still get the well-designed resource editor for dialogs, icons, and the like, as well as a syntax-highlighting text editor. But if you have used any of the more visual programming products such as Borland International's Delphi for Windows or Microsoft Visual Basic, Visual C++ 4.2 seems lacking.

BACKING MICROSOFT INITIATIVES

A big strength of Visual C++ is its support for Microsoft's programming initiatives. This latest release of the Visual C++ compiler comes with its well-known companion, the Microsoft Foundation Classes (MFC). In Version 4.2, MFC has been

enhanced with new classes for Internet clients, and it incorporates the latest developments in Microsoft's ActiveX initiative.

The wide acceptance of MFC has made it the de facto Windows API. But when you ride the MFC 4.2 wave, be prepared to leave some things behind. With Version 4.2, Microsoft has removed Win32s support from Visual C++.

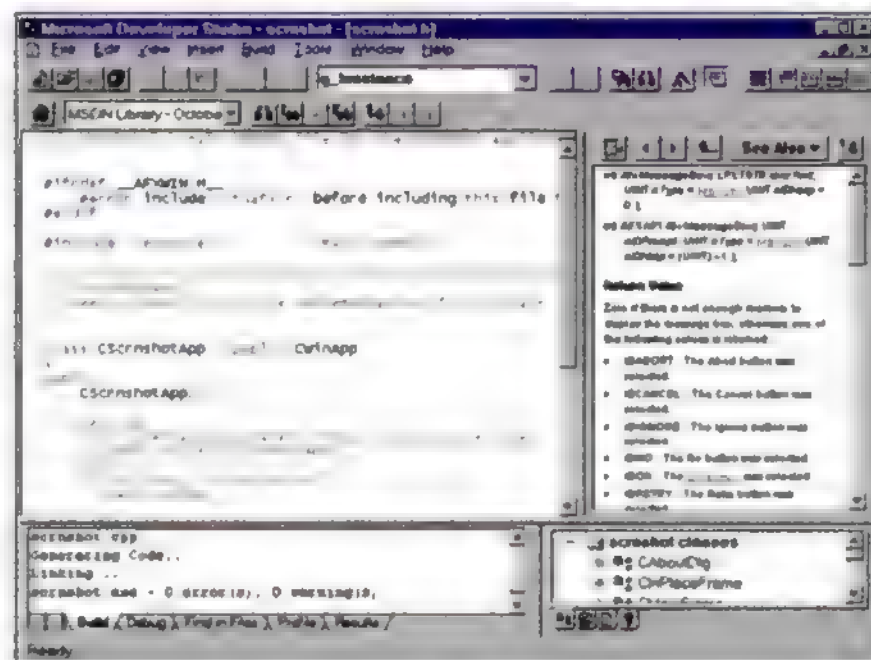
MFC 4.1 included classes that supported server-side Internet programming, so it is not surprising that Version 4.2 contains a number of new classes for Internet client-side programming. Classes such as CInternetSession, CHttpConnection, and CHttpFile provide all the functionality needed to find and read files on Internet servers. The new classes also support FTP and Gopher protocols

as well as a generic CInternetFile class that can be used as the basis for other Internet transfer protocols.

Of particular interest to Enterprise customers are enhancements to MFC's ODBC classes. CRecordset includes new member functions that provide support for multithreading, bookmarks, bulk-row fetching, and improved support for transactions.

Visual C++ 4.2 is the first release since Microsoft renamed and redefined OLE controls as ActiveX controls. This version contains support for the new features such as windowless controls and revised documentation that jibes with the latest Microsoft marketing effort.

To assist in creating ActiveX controls, Microsoft has enhanced the OLE Control wizard. The new implementation includes support for windowless activation and improved drawing and mouse support, as well as asynchronous loading of property



IDE CLASSIC: Microsoft Visual C++ hones the traditional edit/compile/debug environment to a keen edge.

values. The wizard allows multiple controls per project as well as offers the ability to assign a runtime license to a control.

Introduced in Version 4.0, the editor for Visual C++ 4.2 is good—for an IDE. It contains built-in Brief and Epsilon emulation and the ability to reassign edit functions to different key combinations. Syntax highlighting is provided for C++ and, in this age of the Internet, HTML. The problem for longtime pros is that it's not *your* war-horse editor. There are always key-combination incompatibilities for those not used to the Visual C++ IDE.

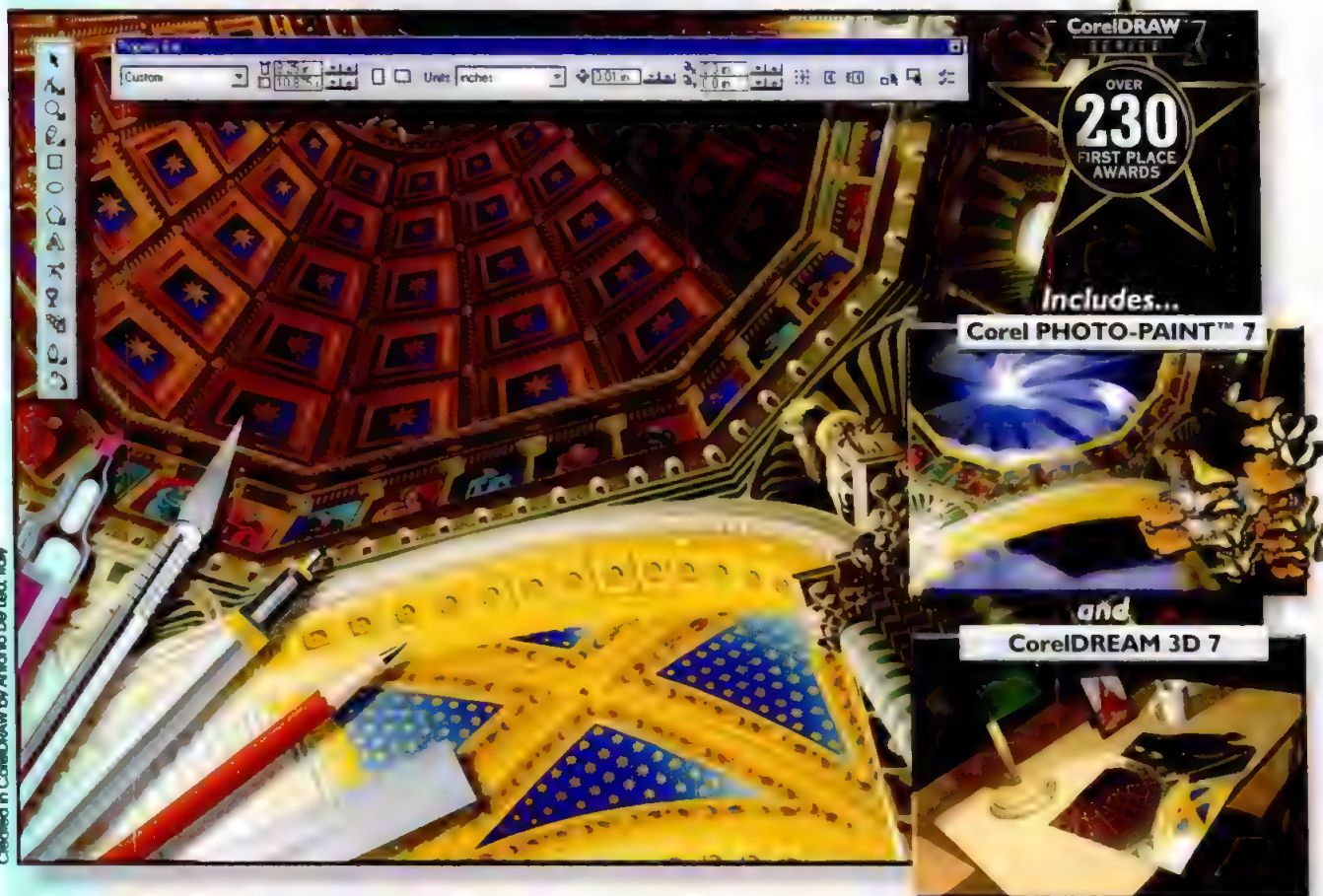
For all the power of the Visual C++ editor, the biggest help in writing C++ code is through the code-generation wizards

SUITABILITY TO TASK

Microsoft Visual C++

	Power	Ease
Internet client/server	Excellent	Good
Database development	Good	Good
Enterprise development	Good	Fair
Rapid application development	Fair	Poor
System-level programming	Excellent	Excellent
Legacy maintenance	Good	Good
Debugging	Excellent	Good

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Borland C++ Builder 1.0: Like Delphi for C++

By Richard V. Dragan

Borland International has a long and honorable history as a C++ tools provider, but in recent years, the company has lost momentum. This will change dramatically with the appearance of Borland C++ Builder 1.0, due to ship shortly after this story appears. In essence, C++ Builder will be a C++ implementation of Borland's pioneering product Delphi, based on Object Pascal. The beta version we tested shows C++ Builder to be a strong contender in bringing visual RAD-tool functionality to C++. The company will also continue to ship and revise its older Borland C++.

DELPHI-LIKE STRENGTHS

C++ Builder will offer many of the familiar Delphi strengths, including a rich component library, excellent database access, and a highly visual programming model. You will even be able to use Delphi Pascal modules inside C++ projects.

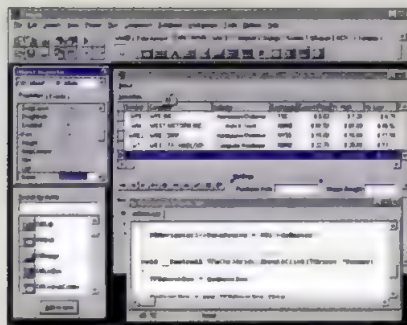
The interface in Borland C++ Builder is closely based on the Delphi model with a toolbar of components at the top of the screen. Programming is largely a matter of designing forms with components from the Visual Component Library. After placing components, you set properties and attach code to events.

The Visual Component Library includes over 100 components, most of which are native Delphi controls distributed in .DCL files. Besides standard Microsoft Windows user-interface objects, there are components for Windows 95 common controls, bound database controls, database objects such as tables and transactions, report writer objects, and Internet components for using the most common protocols. ActiveX (OCX) controls are also supported.

To ease working with components and controls, C++ Builder offers Object Inspector, a grid interface for accessing and setting properties.

Adding a new event is as simple as double-clicking. The event-handler code window is an editing environment that provides syntax highlighting.

In addition to providing a powerful component model, Borland C++ Builder facilitates code reuse in other significant ways. To get you started, the standard targets include standard applications, console applications, DLLs, and Units, Borland's C++ ana-



C++ Builder will have a component-based programming model similar to Delphi's.

log of a Pascal module. Since any project or object can be placed in its object repository for reuse in new projects, it's possible to start a new project quickly based on an existing one.

Significantly, C++ Builder lets you target native components, and these can be subclassed from any existing native control. This means that it's easy to customize and then reuse existing controls. A future version will support OCX control creation as well. For legacy code reuse, Borland C++ Builder promises support for Microsoft Foundation Classes (MFC) and ObjectWindows Library (OWL) code, as well as custom C++ code.

The C++ Builder uses the compiler technology from the Borland C++ 5.0 standalone compiler, and it will support advanced C++ language features including templates, runtime type identification (RTTI), and namespaces. The product also comes with RogueWave's version of the C++ Standard Library, which includes the Standard Template Library for effi-

cient data containers, as well as utility classes such as string classes.

C++ Builder will feature incremental building technology, as pioneered in Delphi. Your project can be built in the background as you edit, resulting in far quicker net-build times.

The C++ Builder debugger is truly integrated; there is no separate debugging option, at least in the beta version we tested. As you run your code, you have access to watches, breakpoints, threads, registers, and call stacks. At any time, you can pause a program, make a change, and incrementally rebuild the project. The form designer, Object Inspector, and other tools still function while a program is running, so it is possible to add new events during the debug process.

As with Delphi, C++ Builder has many enhanced features for targeting database applications. You can use its bound controls for accessing and displaying data in a variety of formats. Database controls provide access to databases, including data sources, tables, stored procedures, and reports. C++ Builder relies on Borland's IDAPI database engine to connect to a variety of SQL and non-SQL data.

Because of the wide variety of Internet controls available, including FTP, HTTP, HTML, SNMP, POP, TCP, and UDP, you can already build a wide variety of Internet clients. For server-side components, Borland C++ Builder will eventually include a vendor-neutral interface for NSAPI, ISAPI, and CGI server-side components.

With its technology from the successful Delphi product line, Borland C++ Builder 1.0 is likely to be a major player in RAD-oriented C++. The initial version appears to be solid and headed for a very capable first release. **Borland C++ Builder 1.0.** List price: Not determined at press time. Borland International, Scotts Valley, CA; 408-431-1000; fax 408-431-1732; www.borland.com. Circle 442 on reader service card.

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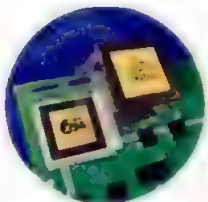
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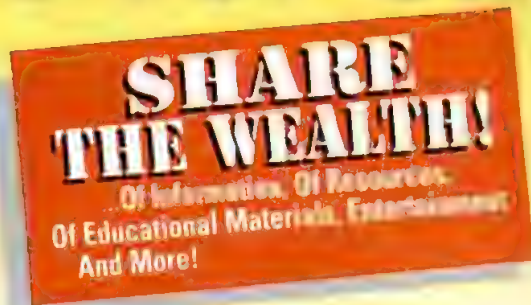
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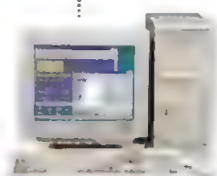
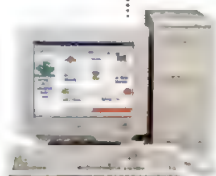
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Symantec C++ 7.5: Building on Firm Foundations

By Richard V. Dragan

Symantec C++ has not had a major overhaul since we looked at Version 7.0 (see "C++ Programming: Significant Development", April 11, 1995), but the company is working on an interim release. Symantec C++ 7.5, which we looked at in beta. This upgrade is due to ship by the time this story appears.

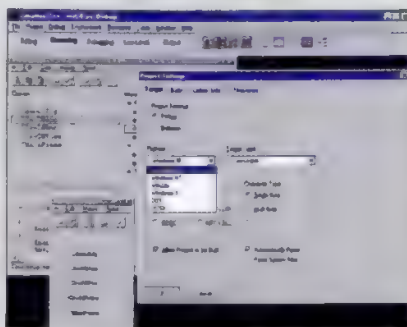
Symantec C++ 7.5 will provide a very capable, though traditional, 3GL approach to C++ development centered on the Microsoft Foundation Classes (MFC). Symantec C++'s particular strengths are its ability to target both 16-bit and 32-bit MFC programs, and its excellent class browser and object viewer. This release will not support ActiveX or OXC components.

Symantec's Integrated Development and Debugging Environment (IDDE) will come in only a 32-bit-hosted version, but an enhanced version of the 16-bit environment from Symantec C++ 7.21 will be bundled with the final release.

The AppExpress tool for generating default projects lets you target both 32-bit and 16-bit MFC applications, as well as OXC controls. Besides Win16, Win32, and Win32s targets, Symantec C++ can build DOS and extended DOS executables. Version 7.5 will bring the product's MFC support up to date with MFC 4.2b for Win32 and MFC 2.53 for Win16 development.

One of Symantec C++'s traditional strengths is the wide variety of views and tools it gives you for managing

projects. The Project Window gives you a traditional listing of all the files in a project. The Hierarchy Editor lets you model a group of classes visually by dragging and dropping. The Class



Symantec C++ can build DOS, 16-bit and 32-bit Windows, and MFC executables.

Editor features a three-paned interface that lets you browse classes, members, and methods, with the code associated with each. This tool in particular gives you an efficient, intuitive interface for getting to your classes. Symantec C++ pioneered background parsing of class information so that you don't have to compile your program to be able to browse its objects.

The code editor in Symantec C++ allows a good deal of customization; some of the features you can personalize include remappable keys; emulations for Brief, EMax, MFCC, and Norton Editor; and color-highlighted keyword highlighting. You can record and edit macros using its ScriptMaker tool. Column copying is supported, and a useful Find tool lets you search files in the current project

or across your disk.

The ClassExpress wizard supports the automation of Win16 and Win32 MFC programming. For 16-bit developers, Symantec C++ supports quick access to VBX controls with its VBX-Express tool, but a comparable feature isn't supported for the newer OXC control model.

For building and debugging code, Symantec C++ offers some notable strengths. One tool, NetBuild, allows for fast distributed builds by doling out build chores among several LAN-connected workstations. Symantec C++'s high-power debugger includes breakpoints, watches, and threads, and lets you examine assembler listings and memory contents. You also have good control over how individual exceptions are handled.

As it prepares to release the C++ 7.5, Symantec is already at work on C++ 8.0, a major overhaul along the lines of its new RAD-oriented Java programming tool, Visual Café. This release will also add support for component-based programming. Ultimately, we expect to see Symantec's C++ and Java tools come closer together—sharing technology and perhaps the same programming environment. This promises to take what is currently a traditional C++ tool into the newly charted world of C++ RAD.

Symantec C++ 7.5. List price: \$79. Symantec Corp., Cupertino, CA; 800-441-7234; fax, 541-334-7474; www.symantec.com. Circle 458 on reader service card.

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Watcom C++ 11.0: Polishing a Winner

By Richard V. Dragan

In our last roundup of C++ tools (see "C++ Programming: Significant Development," April 11, 1995), Powersoft Business Group's Watcom C/C++ 10.0 beat out six other products to win our Editors' Choice. Although Powersoft has since introduced the RAD-oriented Optima++, it has continued to refine the more traditional Watcom C/C++. Still in beta at press time, Watcom C++ 11.0 adds several new features while keeping the fundamentals of an industrial-strength compiler and retaining a low-level, do-it-yourself approach to writing and maintaining code.

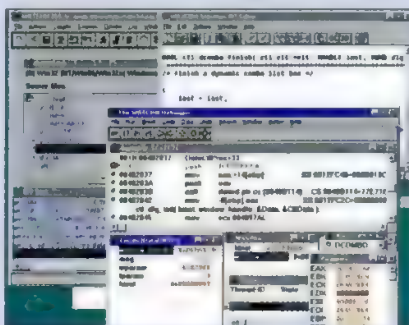
The Watcom C++ environment continues to excel at cross-platform support. The same compiler lets you target DOS, extended DOS, and 16-bit and 32-bit Windows, and you can host these tools in Windows 3.1, Win32, and OS/2 platforms.

Taken as a whole, the editor, the App and Class wizards, and the Project Workspace windows provide the experienced programmer with the tools to develop powerful applications in C++. In fact, in the hands of a true power programmer who knows the product thoroughly, the IDE can really sing. The problem is that it takes a true power programmer to get the most out of Visual C++.

Though you'll spend the most time with the IDE, it's the compiler that does the real work. The Microsoft C++ compiler is pretty darn good: It delivered highly compact code and was the overall leader on our Execution Speed tests. Although it was not always the fastest compiler, its speed was more than adequate. These test results, along with Visual C++'s ability to write ANSI standard C or C++, make this product the top choice of developers looking for the best performance from the target application.

A true hacker's development environment needs a power debugger, and Visual C++ 4.2 obliges. The debugger has the standard register, memory, watch, local, and call stack windows, among others, and it lets you modify memory or variable

Added features in Watcom C++ 11.0 include support for ANSI/ISO C++ namespaces and runtime type identification (RTTI). New compiler optimizations provide Intel MMX



Watcom C++ offers low-level debugging access to the inner workings of your code.

support, and the product bundles MFC 4.1 and new updates to Windows SDK command line tools. Its Visual Programmer, a tool for automatically

generating user interface code, has also been enhanced. You can use this feature to create and maintain the visual elements of your code, which you can customize further.

The fundamental look and feel of the Watcom C++ IDE—a solid 3GL environment with basic source code editing and low-level debugging tools—has not changed. As you might expect, the debugging offers particularly good access to low-level information on multiple operating systems.

For those who need a powerful, traditional tool with strong cross-platform abilities and powerful debugging, this version of Watcom C++ continues to deliver.

Watcom C++ 11.0. List price: \$350. Sybase Inc., Powersoft Business Group, Concord, MA; 800-395-3525; fax, 508-287-1600; www.powersoft.com. *Circle 441 on reader service card.*

values during a debugging session. Runtime monitoring code built into the libraries provides tracking and reporting of memory leaks.

Microsoft Visual C++ 5.0 is due in several months. But a beta was not available for this story, and all we were able to pry from the company were a few design goals. Microsoft plans on improving the runtime performance in terms of speed and a smaller memory footprint. Also, ActiveX support is scheduled to be improved, and the IDE will be beefed up with support for VB Scripting and a tighter integration with the other developer products Microsoft sells.

The improvements Microsoft plans will be welcome, but the current product is clearly no laggard. Its lack of a component-based visual design paradigm to help the programmer leaves it looking somewhat dated, but for down-to-the-metal development work, Visual C++ has no peer.

Microsoft Visual C++ 4.2, Enterprise Edition. List price: \$995. Microsoft Corp., Redmond, WA; 800-426-9400; fax, 206-936-7329; www.microsoft.com. *Circle 444 on reader service card.*

Sybase Inc., Powersoft Business Group Optima++ Professional

BY RICHARD V. DRAGAN



Visual RAD tools have been around for years, but Powersoft Business Group's Optima++ was the first C++ development system out of the gate to combine RAD ease of use with the power of a traditional compile/debug environment. Optima++ 1.5 Professional offers a powerful component model, groundbreaking wizard-based code generation, and excellent database connectivity based on Powersoft's PowerBuilder DataWindow control technology. Except for its sparse support for legacy

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VisualAge for C++ 4.0: Previewing Taligent

By Gabrielle Gagnon

Although Version 4.0 of VisualAge for C++ for Windows isn't due until the fall of 1997, IBM Corp. can't wait to prerelease its new Taligent-based technology. By the time you read this, the VisualAge for C++ Open Class Technology Preview will be available in an open Beta program, and it promises to be a real eye-opener. The prerelease version we saw was surprisingly robust and mature, and it offers such a wealth of features and functionality that you should be able to take off with it immediately.

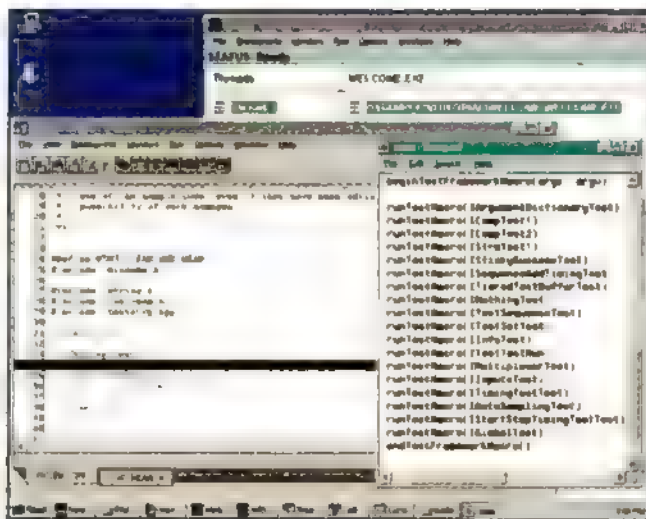
THE BEST OF COMMONPOINT

CommonPoint 1.0 for AIX and for OS/2, both released in 1995, were the first fruits of years of labor by IBM's Taligent project. Taligent's goal was to produce a comprehensive set of frameworks that would handle all of the common application functions. Although the technology was lauded by many, the size and complexity of the CommonPoint frameworks proved too daunting for practical purposes.

Now, the best of the CommonPoint technology is being channeled into Open Class for VisualAge. One of the subsystems, the Compound Document Framework, made its debut in Version 3.5 of VisualAge for C++ for Windows, but numerous additional frameworks will join it in the Open Class Technology Preview. They cover several major application areas including Desktop, Web, Graphics,

and International Text.

The Desktop frameworks will provide an infrastructure for building components such as OCX or OpenDoc. The Compound Document



The Test Framework is one of many pieces of The Open Class Technology Preview.

Framework, which handled only OLE objects in VisualAge, Version 3.5, is being revised and expanded in 4.0 to work with OpenDoc and OCX objects, a standard based on IBM's System Object Model (SOM) technology. The Compound Document Framework classes provide a common programming interface for OLE and OpenDoc components. That means developers can generate cross-platform compound document apps irrespective of component type.

The Web frameworks (called Web Runner), include a Web Access Framework and Web Server Extension Framework, although IBM may include other utilities such as a Web Distribution Manager and Web site analyst. The Web Access Framework

allows drag-and-drop interchange between compound documents and the Internet. The Web Server Framework provides interfaces for extending a Web Server's functionality. It will provide support for Common Gateway Interface (CGI), Netscape Server (NSAPI), and Internet Connection Services (ICSAPI) servers.

The Graphics frameworks comprise five categories of classes for handling 2-D functions, including geometries, modeling, rendering, imaging, and confirmation. The International Text frameworks provide support for displaying and manipulating Unicode text and for localizing applications for different languages. In addition to the major framework groups, Taligent supplied several frameworks for miscellaneous use, including a File System Framework, a Printing Framework, and a Unit Test Framework that provides standard-format base classes for generating tests, accepting inputs, and reporting results.

For sheer breadth of features, the Taligent frameworks are unmatched. An all-encompassing OOP framework has always proved a difficult ideal to realize, but VisualAge's Open Class Technology Preview is by far the most credible attempt we've seen. **VisualAge for C++, Version 4.0.** List price: Not determined at press time. IBM Corp., Armonk, NY; 800-426-2255; www.software.ibm.com/ad/visualage_c++. Circle 460 on reader service card.

code and inability to target its own components, Optima++ sets an admirable standard for ease of use and productivity.

The Optima++ environment resembles RAD tools such as Borland's Delphi and Microsoft Visual Basic: Programming mainly involves designing with objects on forms. It also lets you write code the old way, of course. But its highly capable editor, which provides syntax highlighting, is a far cry from the basic editor of the older Watcom C/C++. (Optima++'s keyword list is not extensible, however.)

The product's background compilation builds modules in the background as you type. After an initial compile, Optima++ marks each line of your source code with a small icon indicating that its syntax is legal. If you make a mistake, the product places a red error icon next to the source code and highlights the error. We found that this approach took some getting used to, but it proved an effective way of helping us find errors quickly.

Optima++ offers a number of views of your project: You can view them as files,

classes, or visual components. The Classes view lets you view your work as a group of C++ classes, with quick access to methods and members. This is analogous to the approach of a traditional class browser, though it doesn't let you view class inheritance. A related option, the Objects view, shows your project as a group of forms and components. This is by the far the most natural way to navigate an Optima++ application, as it most closely matches the product's component-centered model.

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POWER THROUGH COMPONENTS

Optima++ employs its extensive Component Library to help you design with components and forms. The product includes its own set of C++ classes, which provide a native control model, and it supports ActiveX and OCX controls. Component Library has an impressive set of some 150 prepackaged control components, which supply such features as Windows 95 common controls, multimedia functionality, networking, and Internet programming. A core feature of the library is database access, whether through bound controls or through DataWindow controls. With this rich array of components, Optima++ sailed through our test script and let us create database and Internet applications very quickly.

As with other RAD tools, you work with controls in Optima++ by placing them on a form and manipulating their properties visually or through property pages. Another Optima++ tool, Object Inspector, lets you view the properties of all a project's components in a convenient, gridlike interface. It was a handy alternative to the property page that comes with the OCX.

You can attach events to any component using the right mouse button or Object Inspector, which lists all the possible events for a control. Of course, Optima++ writes a good deal of code to manage OCX and native controls. But unless you ask to see it, this complexity is tucked away. Since custom code never mixes with automatically generated code, you can use the visual tools to modify an existing layout without overwriting your work.

Wizard-based assistants simplify writing your own code. If you drag any control to a source code window, the Reference Card wizard brings up detailed help as to all the methods, properties, and events for it. If you select a method, the Parameter wizard fills in the required values, often providing guided choices in drop-down list boxes. It then pastes the method into your source code. Just as important, this wizard tracks the name of each control so that you don't have to refer to header files or other views to obtain the right variable.

The Optima++ compiler uses the same technology as the robust Watcom C++ 10.6. You manage builds entirely through Optima++; there are no command line

tools. C++ purists may miss the ability to add third-party tools to the environment, but the Optima++ debugger is really top-notch. All of a traditional 3GL's debugging features are here, including watches, breakpoints, call stack, and even access to

*Optima++ brings a
RAD approach to C++
without surrendering
the low-level control
that traditional
tools offer.*

disassembly, threads, and registers. An added plus is the support for remote and server-side debugging. During debugging, instead of opening a bewildering number of windows, Optima++ did a good job of window layout on the desktop.

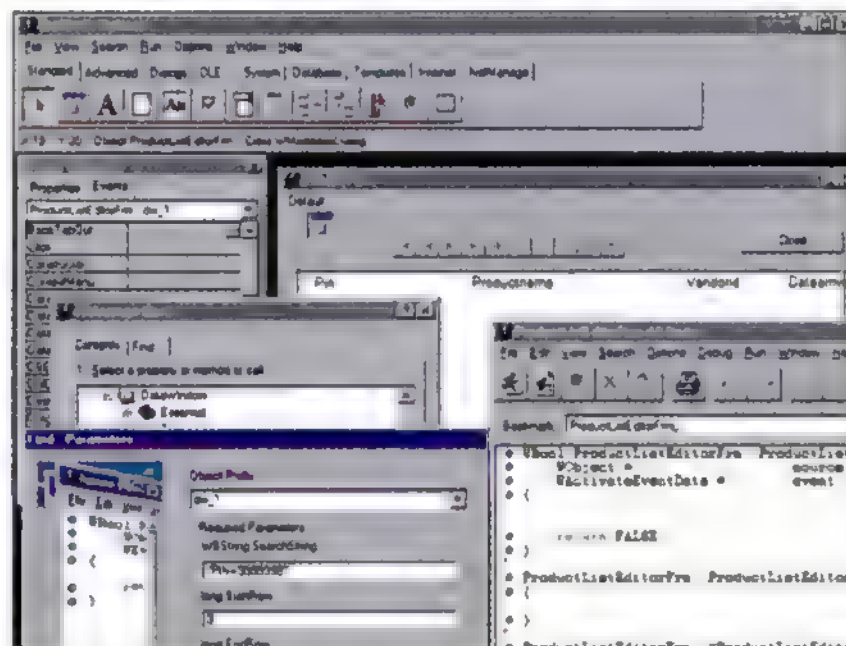
Database support in Optima++ is excellent. Besides bound data controls, the product includes the PowerBuilder Data-

soft's SQL Anywhere 5.0, a powerful database engine with a highly compact footprint. During testing, we found that it was very straightforward, letting us create working database clients with a surprisingly limited amount of coding.

Optima++ also offers a wide variety of target support and installation options, which make it a strong choice for the Internet and the enterprise. Besides Win32 and Win32s targets, Optima++ can generate NSAPI, ISAPI, and CGI targets. It ships with a rich library of NetManage OCX controls for access to common Internet protocols (including FTP, SMNP, and HTTP) and for sockets support. Its HTML control helped us build a working Web browser client with impressive ease. Although Optima++ cannot target OCX components or its native controls, you can save your favorite code to templates for use in new projects. Powersoft plans component and OCX support for the product's next release, which should be available by the time you read this.

For distributing client applications, Optima++ lets you create a single .EXE file (as long as you don't use any OCX controls in your project). InstallShield Express, a utility for creating installation wizards, also comes with the product. For team programming, Optima++ includes hooks for version-control software packages. The separate Enterprise Edition (\$1,999) comes bundled with Object-Cycle, Powersoft's version-control module for source code.

Although Optima++ is an excellent, forward-looking tool for creating new interfaces quickly, it lacks a clear migration path for code written in traditional applications frameworks (like the Microsoft Foundation Class-



Niceties like the Parameter Wizard make Optima++'s form-based programming model even easier to use.

Window. This control lets you automatically generate working database forms from existing queries or from views that encapsulate a great deal of the transaction logic. In addition to ODBC access, the DataWindow provides native drivers to popular SQL servers, including Sybase System 11 and Oracle 7.1. The DataWindow's Builder wizard delivers considerable database simplicity and power.

Optima++ also comes with Power-

es). But on our tests, using existing C++ libraries with Optima++ was relatively easy. If you are willing to repackage your legacy code into ActiveX/OCX controls, you should not hesitate to consider Optima++ for new projects. But don't expect to migrate existing user interface code into Optima++ easily.

All in all, Optima++ leads the field: The product brings a RAD approach to C++ without surrendering the low-level

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PERFORMANCE TESTS

C++ Development Tools



Overall, Microsoft Visual C++ took the lead in two of the three traditional metrics of compiler performance: execution speed and executable size. Optima++ proved to have the fastest compiler. As build systems become more powerful and C++ products evolve in the direction of RAD tools, compiler speed becomes less important, while overall productivity of the environment becomes critical.

How We Tested

This issue's tests of C++ tools combined our traditional speed and size tests with a script designed to exercise the task-specific productivity features of each tool. As in past reviews, we invited all vendors to PC Magazine Labs in New York to work with our reviewers and labs staff during the evaluation. The three-day testing cycle consisted of one day of performance tests and two days of scripted application building and debugging.

All the test results charted here are based on CPPMark, a suite of eleven performance tests created by PC Magazine Labs to measure some of the important features of today's C++ development environments. CPPMark is primarily designed to measure the speed of compiled code, but we also used the same code base as a target to measure compilation speed and code size. For the timed tests (Execution Speed and Full Debug Build), we ran each test three times on a Pentium/133-based Micron system with 32MB of RAM running Microsoft Windows 95, and we rebooted the system between runs. We report the average score for each product. The Executable Size test required only a single run.

scores indicate better code performance.

In the first four tests, we were interested in measuring the performance of each platform using the C++ Standard Library, a set of ready-to-use template classes for data containers. We turned to RogueWave Software's implementation of the Standard Library, which offered good cross-compiler support. We allowed each vendor, if it chose, to rebuild this library with varying parameters to help achieve the best results possible in the Execution Speed, Executable Size, and Full Debug Build performance tests.

The **Standard Library String** test measures the speed of common string operations including searching, assigning, and copying randomly generated strings. (As a rule, we did not time the generation of random values in our tests.)

The next three tests use Standard Template Library template classes for common data containers. The **STL Vector** test uses the vector template, which allows programmers to create dynamic, resizable arrays easily. This test uses 200 randomly generated long and string items and performs operations such as inserting, searching, and deleting elements.

Along the same lines, the **STL List** test uses an STL list template class with 100 long and string items. The **STL Map** test examines the map vector, which lets programmers easily associate pairs of items (called *keys* and *values*). For this test, we use 200 long keys mapped to randomly generated strings of 50 characters and perform insert, search, and delete operations. Since the map template requires that keys be unique, we use predetermined numbers for keys. The **Complex Arithmetic** test uses the Standard Template Library complex-number template and performs extensive floating-point calculations, including trigonometric and logarithmic functions, on an array of 1,000 complex numbers using the C/C++ double type.

The next two tests are also floating-point-intensive. The small and large **Fast Fourier Transform** tests perform the fast Fourier transformation from physics. The code in each is identical, but the small test uses a 300-element array and the large test a 1,000-element array. This test also makes use of the complex-number template of type *double*.

To test heavily integer-based processing, we used Greenleaf Software's ArchiveLib, Version 2.1—a C++ library that supports file compression and decompression. The **File Compression** test



Execution Speed

Our Execution Speed tests, based on CPPMark, model a number of different types of application behavior, showing each compiler's abilities at generating code for particular tasks. After compiling CPPMark using each development tool's compiler, we ran each of the 11 tests for 30 seconds and used a timed loop to measure the number of test iterations performed. For all these tests, larger

measures the number of times a 63K text file can be compressed in memory. The **File Decompression** test measures the reverse process—unzipping the file into a memory buffer. The **Encryption** and **Decryption** tests use the same file, with the added option of ZIP file encryption. Encryption adds even more integer-based calculation to the workload of the File Compression and Decompression tests. For all four tests, we perform file compression and decom-

pression in memory. We do not measure disk activity as part of these tests.

Executable Size and Full Debug Build

For these tests, compiler vendors used their own build options to optimize for size and speed. In all cases, exception handling was turned off.

The **Executable Size** test looks at the size of the disk image of the test .EXE produced by each compiler, including our performance test code, the two C++ class libraries for the RogueWave C++ Standard Library, and the file archive package from Greenleaf Software.

Our **Full Debug Build** test measures an aspect of compiler performance that directly affects the programmer: the speed of debug compilation. We do not look at the time required to create a release build, as this is a one-time operation. We also do not look at partial debug builds, as background compilation in some of the products makes a direct comparison impossible (and effectively eliminates partial builds as a separate operation).

Suitability to Task

The best way to measure the productivity of a tool is to use it. As the basis for our seven Suitability to Task ratings (see the individual reviews), our reviewers worked with the vendors to build four mini-applications that are representative of work that programmers are doing today: desktop, database, Internet client, and Internet server.

The *desktop* application was a utility that loads and views a bitmap, a text file, and (using an ActiveX control) a spreadsheet. The *database* application was a front end of an order entry and retrieval system, which uses an ODBC or native connection to a SQL database back end. The *Internet client* application was an HTML browser that could retrieve and display Web pages, as well as saving the page—complete with images—to a file. The *Internet server* application was a simple application that retrieved the standard CGI variables via a Web page request. The vendor was asked to use standard CGI and, optionally, the Netscape NSAPI or Microsoft ISAPI server interface, if supported.

While C/C++ by itself is powerful enough—given the time—to build any of our applications, we were looking for program features that facilitated the task, such as wizards, components, or class libraries. If the product did not support the task without extensive coding, we skipped the task and asked the vendor to demonstrate any additional product features that it felt were relevant to our review. The process of building the applications drew on all aspects of development, writing, compiling, debug-

form. For productivity and usability testing, we used separate Micron Millennia 133s running Windows 95 and Windows NT 4.0. We included the Windows NT machine because many programmers run Windows NT as a development platform of choice.

We used two widely known third-party libraries in the creation of our CPPMark performance test suite. The Rogue Wave Standard C++ Library, Version 1.2, is a cross-compiler implementation of the current ANSI definition of the STL (Standard Template Library), along with other classes and templates. (Rogue Wave Software Inc., Corvallis, OR; 800-487-3217, 541-754-3010; fax, 541-757-6650; www.roguewave.com.)

The Greenleaf ArchiveLib, Version 2.10, is a cross-platform and cross-compiler library that provides compression and decompression class libraries for C and C++. (Greenleaf Software Inc., Dallas; 800-523-9830, 972-248-2561; fax, 972-248-7830; www.gleaf.com/~gleaf/index.html.)

What the Numbers Mean

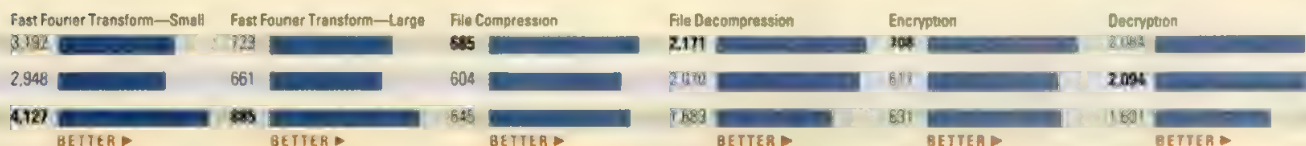
Microsoft Visual C++ 4.2 was the winner on the Execution Speed tests, winning 6 out of 11 tests and averaging significantly above both Optima++ and VisualAge for C++. These tests revealed a wide discrepancy in template implementation, although Visual C++ was solid on nontemplate tests as well—suggesting that its superior performance was also attributable to overall compiler optimizations.

Powersoft agreed that the current version of the Optima++ compiler performs poorly on register inlining with templates. According to the company, this limitation will be fixed in a future release. Optima++ clearly underperformed on the STL Map test and the Complex Arithmetic test, as well as the Fast Fourier tests, which also make use of a complex-number template.

Executable Size and Full Debug Build

Microsoft Visual C++ produced the smallest executable by a wide margin. An important factor here seems to be its function-level linking. Normally, when a library or object module is linked, all of its functions are pulled into the executable. Microsoft's linking technology increases the granularity to the function level, rather than a module level, thus eliminating unused code. Since our test included two additional C++ libraries with many additional classes, the overall impact of this feature was increased.

For the Full Debug Build, Optima++ proved to be modestly faster than Visual C++, with VisualAge for C++ trailing by a wider margin. All the compilers offer an acceptable level of speed on a reasonably high-powered development system.—*Analysis written by Jay Munro and Richard V. Dragan*

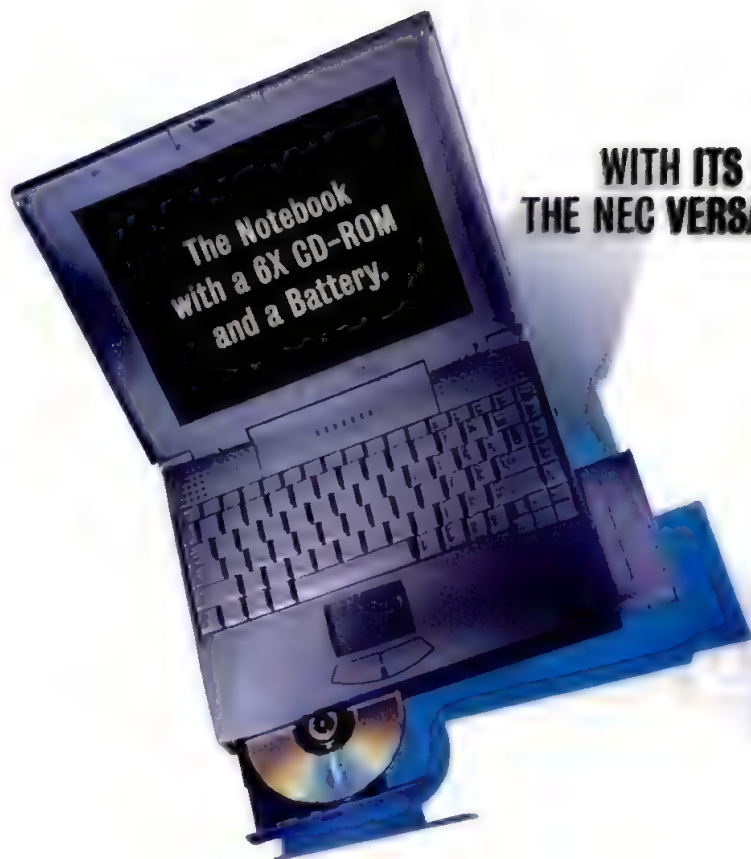


ging, and testing, providing an excellent overview of the entire environment.

Test Equipment and Third-Party Libraries

We ran all our tests on a single Micron Pentium Millennium/133 with 32MB of RAM running Microsoft Windows 95. We used Windows 95 for speed tests, as this is the most common 32-bit desktop plat-

	Executable Size	Full Debug Build
	Bytes	Minutes:seconds
Microsoft Visual C++	169,472	2:30
Optima++	210,432	2:23
VisualAge for C++	268,288	2:47
	◀ BETTER	◀ BETTER



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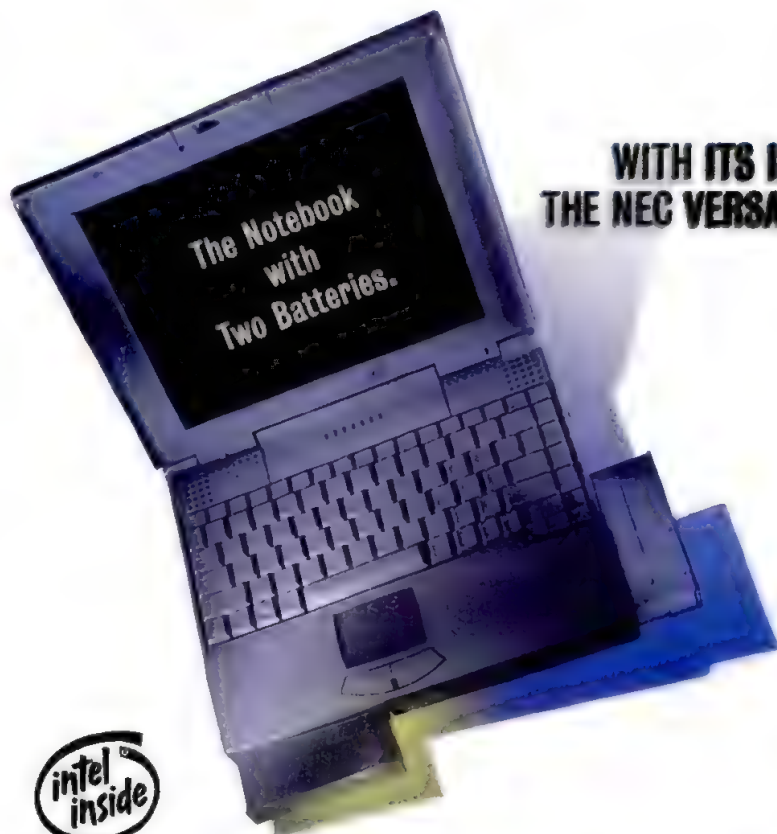
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control offered by traditional tools. The focus on databases and the Internet will be of particular interest to corporate developers. With the introduction of such a tool, it's clear that C++ development has changed for good.

Optima++ 1.5 Professional. List price: \$999. Sybase Inc., Powersoft Business Group, Concord, MA; 800-395-3525; fax, 508-287-1600; www.powersoft.com. *Circle 441 on reader service card.*

IBM Corp.

VisualAge for C++ for Windows

BY GABRIELLE GAGNON

VisualAge for C++ for Windows, Version 3.5, is the latest development package in IBM's multilanguage family of VisualAge products. IBM's goals for this product line are easy cross-platform portability and scalability within each language and a common development environment across all the supported languages. With this release, IBM shows that it is well on its way.

Currently, the VisualAge for C++ development platforms include OS/2, Windows 95, and Windows NT (as well as Windows 3.1x with the Win32s extension as a target platform). Motif versions for AIX and Solaris are in the works. IBM's Open Class Library, which comprises the foundation classes for VisualAge, is already available on those platforms as well as on OS/400 and MVS. IBM plans for Open Class Library to support HP/UX in the future.

ENTERPRISE FOCUS

VisualAge caters primarily to enterprise developers who deal regularly with cross-platform and cross-training issues. These individuals need an efficient way to design and build mission-critical applications on one platform and deploy them on others. The product also targets organizations that have invested heavily in legacy systems on minicomputers and mainframes; it addresses their needs very well.

VisualAge's strong cross-platform support promotes portability (if sometimes at the expense of platform-specific niceties), and its Open Class Library is abstract enough to accommodate multiple APIs, including OpenDoc and OLE. Its Unicode

SUMMARY OF FEATURES

C++ Development Tools

PC MAGAZINE
EDITOR'S CHOICE

PC MAGAZINE
EDITOR'S CHOICE

■ YES □ NO

Products listed in alphabetical order

	Microsoft Visual C++ 4.2 Enterprise Edition	Optima++ 1.5 Professional	VisualAge for C++ for Windows 3.5
List price	\$995	\$999	\$449
Compiler Features			
Size/speed/processor optimization	■ ■ ■	■ ■ ■	■ ■ ■
Precompiled headers	■	■	■
Background compiling	■	■	■
Allows class browsing before full compile	■	■	■
Platforms supported (host/target):			
Windows 95	■ ■	■ ■	■ ■
Windows NT	■ ■	■ ■	■ ■
Win32s	■ ■	■ ■	■ ■
Database			
Generates form automatically from schema	■	■	■
Bound database controls	■	■	■
Remote SQL debugging	■	■	■
User can edit stored procedures	■	■	■
Database access or management classes	■	■	■
Local developer database included	■	■	■
Language Features			
Templates	■	■	■
C++ exception handling	■	■	■
NameSpaces	■	■	■
Editor			
Remappable keys	■	■	■
Syntax/extensible highlighting	■ ■	■ ■	■ ■
User can drag and drop text into editor	■	■	■
Wizards or Code Generators			
Class/Application	■ ■	■ ■	■ ■
Project or target	■	■	■
Installation	■	■	■
Target CGI/ISAPI/NSAPI server application	■ ■ ■	■ ■ ■	■ ■ ■
Help	■	■	■
Development Environment			
Context-sensitive help	■	■	■
Third-party program launch	■	■	■
OLE/ActiveX component support	■ ■	■ ■	■ ■
Version control/Version-control hooks	■ ■	■ ■	■ ■
Programming Tools			
Hierarchy viewer/Class browser	■ ■	■ ■	■ ■
Profiler/Help compiler	■ ■	■ ■	■ ■
Resource editor	■	■	■
Windows application framework	■	■	■
Debugging Features			
Remote debugging	■	■	■
Server-side debugging	■	■	■
Win32s debugging	■	■	■
.EXE or DLL browser utility	■	■	■
Message spy	■	■	■
Includes a process monitor	■	■	■
Classes and Libraries			
Create OCX/ActiveX components	■ ■	■ ■	■ ■
Create SOM and DSOM components	■	■	■
Create proprietary components	■	■	■
MFC included/supported	■ ■	■ ■	■ ■
OpenClass included/supported	■ ■	■ ■	■ ■
Includes FTP/HTTP/SNMP libraries	■ ■ ■	■ ■ ■	■ ■ ■
Mail (MAPI) classes	■	■	■

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support facilitates multilingual applications. VisualAge's System Object Model (SOM) and Distributed SOM (DSOM) even make the programming language irrelevant: Whether written in C++, Smalltalk, or COBOL, SOM's language-independent objects all talk to each other.

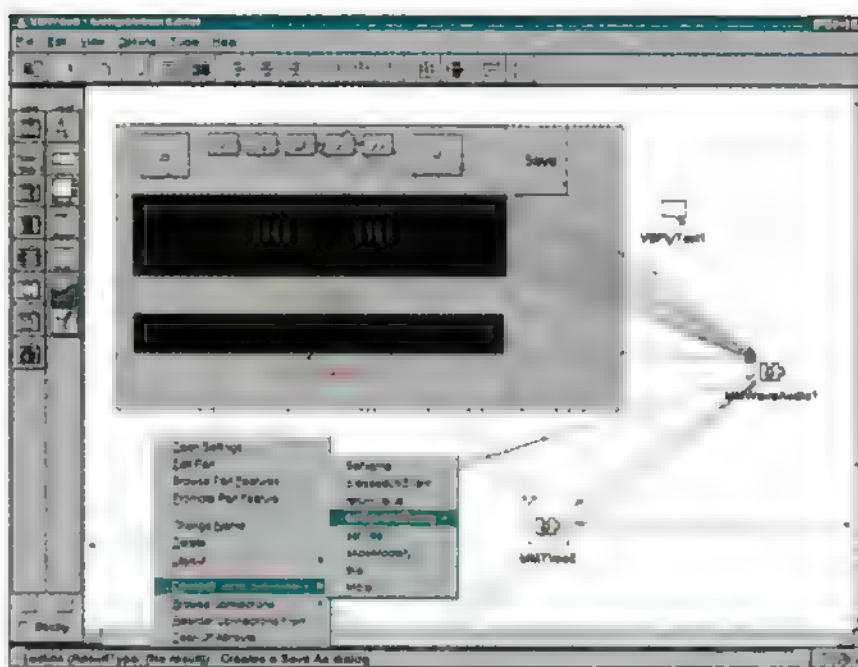
Companion IBM products strengthen VisualAge as an enterprise tool. These products are TeamConnection (\$1,999), which provides team development tools; TeamConnection Exchange (\$19,999), which assists with configuration management; and Configuration Management Version Control (CMVC) (\$2,500), which offers version control services.

VisualAge itself is a medley of eye-catching visual tools and sturdy, behind-the-scenes workhorses. Whenever possible, it applies the OOP principle of programming by exception. Productivity aids give developers a good head start on building their applications; such aids include ProjectSmarts, which groups skeleton projects and templates based on their types, and Open Class Library, which includes application frameworks with hundreds of classes. IBM's Direct-to-SOM (DTS) feature is another major time-saver.

The biggest workhorse in the background is the Open Class Library, which comprises the set of classes that are common to all the VisualAge platforms. In addition to supplying specialized classes for handling complex math, I/O streams, collections, data types, and exceptions, it provides the technology underlying Data Access Builder and the VisualBuilder user interface classes. (VisualBuilder is discussed below.) The newest addition to the Open Class Library is the Compound Document Framework, the first of several Taligent frameworks that will ship with upcoming VisualAge releases.

Other VisualAge tools include Workframe, an open, configurable IDE; a class browser that traverses the class hierarchy graphically; Performance Analyzer, which helps you fine-tune applications; a multilanguage parsing editor; Win32 SDK tools; and the veteran C++ Set, an optimizing compiler, linker, and debugger.

The visual toolset's centerpiece is VisualBuilder. This tool uses a construction-from-parts approach, in which you assemble applications by linking objects via connectors. You select parts from a



VisualAge for C++'s construction-from-parts approach makes programmatic relationships visible.

palette, place them on a canvas, and define the connections between them. Parts are encapsulated objects that may be visible (such as push buttons) or invisible (such as query result sets), and they may be combined with other parts and encapsulated to create composite parts.

VisualBuilder depicts correlated events, attributes, or actions as directional arrows. In a connection between attributes, a change made to an attribute in the first part will trigger a change to the one in the second part. VisualBuilder has already defined most of the connections anyone could need, so very little coding is necessary.

Once it has encapsulated a new part, VisualAge can then generate the C++ code for the application. The part definition becomes portable, so that you can use it in any of the VisualAge platforms that support VisualBuilder and reuse it in other VisualBuilder applications.

Another major visual tool is the Data Access Class Builder. It automatically maps a database table's schema to a C++ class and lets you select, insert, update, and delete data without writing any SQL.

The Data Access framework, too, han-

dles connection services and transactions behind the scenes. The developer simply has to pass parameters to the appropriate method. But although it's a good idea, it's limited by VisualAge's artificial way of mapping objects: There isn't any way to perform joins or similar relational operations, since a class corresponds to a single table. Real-world objects map to multiple tables if the database is properly normalized, and with IBM's approach, a DBA would have to set up views for those objects in advance.

VisualAge supports embedded SQL and Call Level Interface (CLI) access for DB2. In addition, ODBC support is available for Oracle, Sybase, and other ODBC databases.

Although VisualAge's cross-enterprise strategy offers tremendous power and flexibility, it has some drawbacks. Windows programmers will miss the familiar Windows environment and its platform-specific standards. The VisualAge environment, an odd mixture of OS/2 and Motif elements, may seem alien to them. (In an effort to bring the product to market quickly, IBM opted to retain the mostly OS/2 look and feel until the next release.)

Underneath the covers, other Windows mainstays are also missing. We had to adjust those tests that use the ANSI standard template library, because VisualAge doesn't provide it. Even though Open Class Library supplies equivalent functionality, we had to rewrite the code. In addition, VisualAge does not support MFC, MAPI, and ActiveX.

VisualAge's Open Class Library interface simplifies some Windows operations. Creating an OLE server, for example, is a breeze compared with doing so with the Microsoft API. But in general, Windows-only programmers would do better to choose another package. For developers wrestling with cross-platform enterprise tasks, VisualAge for C++ offers powerful leverage and a productive approach. □
VisualAge for C++ for Windows, Version 3.5. List price: \$489. IBM Corp., Armonk, NY; 800-426-2255; www.software.ibm.com/ad/visualage_c++.com. Circle 443 on reader service card.

SUITABILITY TO TASK

VisualAge for C++ for Windows

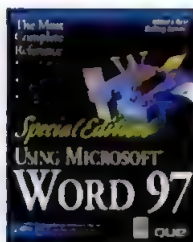
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Debugging	Good	Good

N/A—Not applicable: The product does not support this feature.

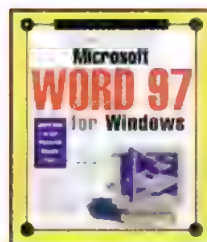
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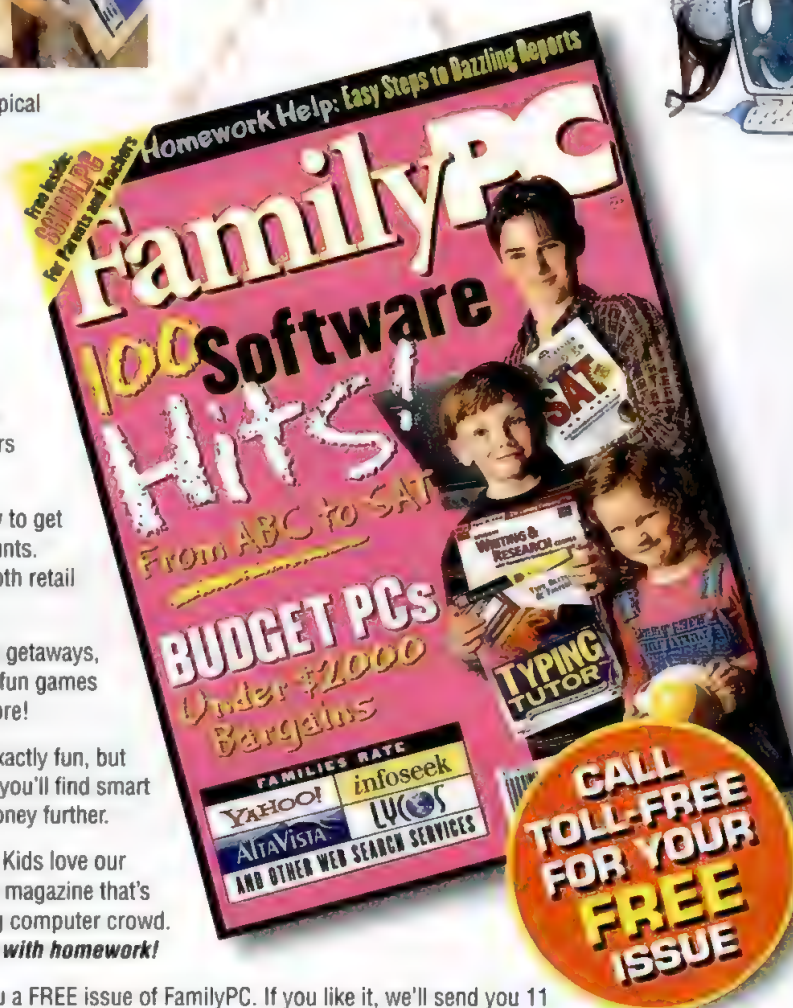
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JavaBeans 1.0

A new model for building dynamic, interactive components for the Internet.



By Richard V. Dragan

By any account, the Java programming language is a great success story. As a compact and powerful environment for building portable Internet and intranet applications, Java is rapidly becoming the developer's tool of choice. One limitation, however, is that while Java applets provide a simple component model, they can't interact with each other. Now Sun Microsystems—with a lot of input from tool vendors—has defined the JavaBeans 1.0 specification, a model for building components that can be dynamic and interactive. With a host of vendors lining up behind it, the new component model appears to have a great future. Understanding what JavaBeans are and how they work will likely be an important part of Internet programming for the foreseeable future.

You might wonder why we need another component model. After

IN THIS SECTION



TUTOR The best way to learn about a programming environment is to write applications using it. Programming Windows applications has long been considered difficult to learn, but in this first part of a series on building applications with Visual C++, Jeff Prose helps dispel that belief. Follow along on the guided tour of developing a basic Windows application—starting with the AppWizard code generator. *Page 229.*



POWER PROGRAMMING

Netscape Navigator and Microsoft Internet Explorer own the Web browser market. Now we show you how to expand the capabilities of both Navigator and Internet Explorer using Netscape's Plug-in API, which both browsers support. The Plug-in API lets you instruct the browser to use your application when it encounters a MIME type you've specified. *Page 233.*



OPERATING SYSTEMS

If you're thinking about creating a corporate intranet or connecting your LAN to the Internet, Microsoft Windows NT Server 4.0 is just what you need. It has everything you need in a file and print server, and with the addition of several impressive features, it's even more powerful as an intranet server. *Page 245.*



UTILITIES

If you've ever lost a URL that someone sent you through e-mail or that you read in a newsgroup, this issue's utility is for you. ClipAid lets you manipulate URLs more conveniently, using the Windows Clipboard. It automatically recognizes when you've copied a URL into the Clipboard, and it allows you to paste a URL onto the desktop or into any folder as an Internet shortcut. *Page 253.*

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all, in a world of competing document-sharing models like OLE/DCOM, DSOM, OpenDoc, and CORBA, there would seem to be enough powerful and sophisticated specifications to go around. Why couldn't Sun pick one of the existing protocols for its Java component model? Microsoft Corp.'s ActiveX components (based on OLE/DCOM), for example, have been very successful so far in exploiting the strengths of OLE and DCOM architecture on the Internet.

The answer is that the existing technologies are complex, and Sun is pitching Java as an easy-to-use solution. Sun's keep-it-simple philosophy means programmers should not have to learn other tools and technologies in order to create JavaBeans. Also, the other data-sharing mechanisms are not necessarily geared to components. (Microsoft originally designed OLE as a solution for in-place editing. Components came later.) JavaBeans, on the other hand, have been designed from the ground up with input from tool vendors. The list of Sun's partners is impressive. Netscape Communications Corp., Apple Computer, IBM, Lotus Development Corp., Borland International, Symantec Corp., and others combined talents—and tool-writing experience—to help define the specification. The result is a simple and highly usable way to package and share Java components. Since Sun has delivered just what the tool vendors ordered, it's no surprise that a lot of vendors will be nearing completion of JavaBeans-based tools by the time you read this.

JAVABEANS VS. ACTIVEX

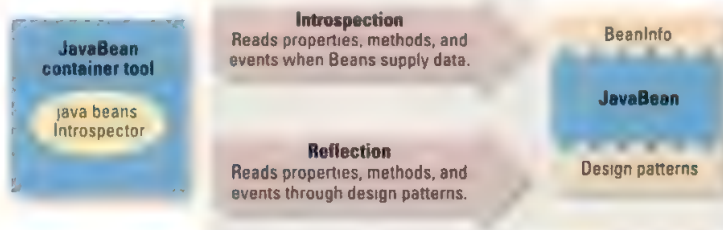
For Web-based development, a JavaBean component's immediate predecessor is the ActiveX control. Underlying the two control models, though, are differing approaches to providing reusable components. The most obvious differences are in overall complexity. ActiveX is more difficult for programmers to master—though admittedly, it does more. ActiveX lets you share documents as well as components. ActiveX controls make use of *type libraries*, normally contained in .TLB files, to publish their functionality. By installing a type library into the system registry, an ActiveX control enables another component to determine what services it provides. Normally, there is a separate development step, though it can be automated, for creating .TLB files. This approach means that ActiveX controls can be written in different programming languages—C++, for example,

or Visual Basic, or lately, Java. Objects can talk to one another without knowing the particulars of how each one operates. Yet, despite its language independence, ActiveX is proprietary and platform-dependent.

A JavaBean control, in contrast, involves no extra step to publish its functionality. By conforming to naming conventions for properties and methods, any JavaBean-based tool can read what capabilities are available in a JavaBean. That means, of course, that JavaBeans must be written in Java (though you could “bridge” a control written in another language using Java stubs or another bridging mechanism). Because of these naming conventions,

Analysis of a Bean

The JavaBeans Specification 1.0 (using Sun's JDK 1.1) offers two ways for JavaBeans to publish their capabilities. For advanced JavaBeans, programmers can describe the properties, methods, and events of their Beans through classes such as BeanInfo. On the container side, the Introspection APIs let a container read this information. For simpler components, containers can check the contents of a JavaBean through *design patterns*—or default naming conventions for properties, methods, and events—that require no extra work for programmers to use.



there is a basic level of interoperability among JavaBeans that developers get for free. The result is platform-independent components that will run just as happily in a Windows browser as under Unix.

READING A BEAN

A JavaBean must conform to certain design rules. It must publish its *properties* (for instance, visual characteristics like size or color), its *methods* (what functions it knows how to provide), and its *events* (actions, such as mouse clicks, that it can pass up to its parent). The JavaBeans specification offers an elegant and simple solution by supporting *reflection* and *introspection*, processes that enable a container to read the contents of a bean.

At the simplest level, a JavaBean uses reflection to publish its capabilities, using *design patterns*—essentially *naming conventions* that a JavaBean creator should follow. For a simple property like a string named Label, for example, you'd include the following methods in your Java class:

```
public String getLabel() {}  
public void setLabel(String  
    newLabel) {}
```

By using the get and set prefixes in your method names, you tell the world you have a property named Label. The JavaBean tool can read the class information in your .class file and know the contents of your JavaBean.

Boolean properties require a different convention, using is and set in method names:

```
public boolean isBold() {}  
public void setBold(boolean b) {}
```

Other rules exist for handling other properties, such as those that map to arrays of values—elements in a listbox control, for example.

Events, too, can be published automatically by the use of naming conventions. If you use pairs of methods whose names begin with add and remove, for instance, a JavaBean tool can determine what events will be generated by a JavaBean.

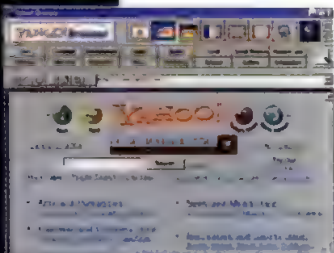
General-purpose methods also get published in this design-pattern model by being declared public. Any method can be effectively exported into a JavaBean consumer with just that simple step. Conversely, anything you don't want the outside world to see would be marked protected or private; the designations keep a bean's internals out of public view.

You probably know some programmers who would bristle at the idea of enforced naming conventions. JavaBeans provide an alternative approach. A bean can supply explicit information about a class using a BeanInfo class, which contains all the properties, events, and methods used inside a JavaBean. The programmer sets individual properties, events, and methods using a BeanInfo class and several descriptor class types (for example, PropertyDescriptor, for specifying properties, or MethodDescriptor, for specifying methods). To some extent, naming conventions do come into play here as well, as when defining a BeanInfo class. When a tool wants to find out about a JavaBean, it asks with the Introspector class by name, and if the matching BeanInfo is found, the tool uses the names of properties, events, and methods defined inside that prepackaged class. If not, the default is to use the reflection process to investigate what methods exist in a particular JavaBean class. By using design-pattern conventions, any tool can read the contents of any JavaBean, even if a programmer chooses the simpler default style for publishing what a JavaBean can do. In either case, there is no system registry to update and no separate repository of JavaBean informa-

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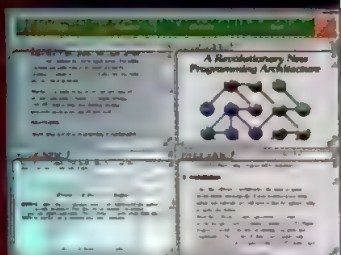
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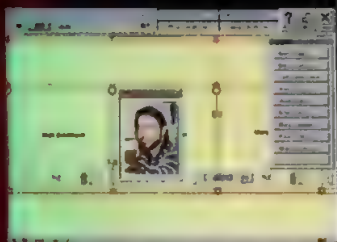
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tion. (The class loader in the new JDK 1.1 allows classes to read the executable .class files of other objects.)

ENHANCED EVENT MODEL

Several important enhancements will appear in the Abstract Windowing Toolkit (AWT) and other standard Java classes in JDK 1.1 that will facilitate JavaBeans development. First, the AWT event model has been enhanced and simplified. Two basic event types are now supported: *unicast events*, for one listener or receiving control, and *multicast events*, for multiple listeners. Objects can now register themselves as listeners for events, an important improvement over the older style of filtering events back and forth across a hierarchy of objects relying on inheritance. The new model relies instead on delegation to determine which objects process particular events. This model is easier for programmers to work with and includes the provision for an *event adaptor*—a Java interface that intercepts and filters events. The result should be a more organized and customizable event model, certainly important for a JavaBean component, which needs precise control of where to send its events.

The design of the JavaBean component model emphasizes ease of use, both when a bean is an active component inside a running application and when it is used inside an application builder. This is evident in the provision, in the form of appropriate support classes, for *customizers*, wizard-like programmer's assistants to be used at design time. An example might be a database wizard that would help a programmer design, through a succession of dialogs, a query whose results would be displayed by a JavaBean. Presumably, the availability of customizers will lead to more complex JavaBeans with fancier options for assisted development. In any case, the JavaBeans specification supports splitting off the design-time and runtime parts of a component, so that providing rich customizing tools for a developer doesn't necessarily mean increased downloading time for a user.

Customizing suggests another important aspect of JavaBean programming: *persistence*. Individual beans need a way to store properties and other state information and then read that information back, so they can retain their appearance and behavior when used at a later time. JavaBeans rely on the Java stream classes—namely, the `ObjectOut-`

`putStream` and `ObjectInputStream` classes—for saving and retrieving their state information. Those classes are written to .SER files, presumably locally during design time. During runtime, .SER files would be made available remotely so that a bean would know its data. Note that persistence is not required to program with beans.

Persistence is enhanced by the JavaBean .JAR file, the standard packaging mechanism for JavaBeans. A .JAR file is really a .ZIP file and can hold multiple .class files, Java executables, or .SER files, which might contain their states. .JAR files can also contain images, multimedia, or any other file type. By this

means, JDK 1.1 supports the equivalent of a resource model, where a single file can be downloaded and parsed into individual files, reminiscent of Microsoft's .CAB file approach to downloading ActiveX controls. The guide to the contents of a .JAR file is the MANIFEST file, which lists any JavaBeans contained inside. The new JDK class loader provides APIs for

downloading, parsing, and extracting files easily. Additionally, .JAR files can be signed, for authentication. There is also a provision for HTML-based help files to describe the use of a JavaBean.

While there are naming conventions defined for .JAR and MANIFEST files, the conventions of actually storing JavaBeans are left up to programmers. There is little attempt to provide structured storage in the current release, although it will be provided in the future. Structured storage would allow, for instance, JavaBeans to embed other JavaBeans and make sure their information is stored in an efficient manner.

Tool Support for JavaBeans

Many major vendors of programming tools have announced plans to support JavaBeans as soon as JDK 1.1 is released, scheduled as of this writing for early 1997. Among them:

- Asymetrix Corp.'s SuperCede for Java will include JavaBeans in the release that follows Version 1.0.
- Borland International's Open JBuilder 1.0 (formerly code-named Latte) will include an extensive library of JavaBean components.
- IBM's VisualAge for Java 1.0 will support the building and scripting of

JavaBeans components

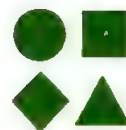
- Lotus Development Corp. has announced full JavaBeans support in Domino 5.0 servers and Lotus Notes 5.0 clients.
- Microsoft Visual J++ will include support for both JavaBeans and ActiveX in a future version.
- Sybase will support JavaBeans in the next release of Optima++.
- Symantec Corp.'s Visual Café 1.0 is now shipping with JavaBeans support based on a preliminary version of the Sun JDK, Version 1.0.2.

If the JavaBeans specification involved just a few extra classes and names, the new components would almost certainly exist already. The reason JavaBeans tools are still under construction is that the Sun JDK 1.1, which is not yet available, will provide the underpinning of several important features. To enable the early development and deployment of beans, however, Sun has defined a set of rules for producing beans compliant with the JavaBeans 1.0 architecture but usable now to build applets and applications that can run on JDK 1.0.2 and on JDK 1.0.2-enabled systems, such as Netscape Navigator 3.0 and Microsoft Internet Explorer 3.0. These transitional beans will, of course, use only a subset of the complete version. But since the subset includes the basic property/method/event mechanisms, they can still be very useful. A separate toolkit for JavaBeans development—the Beans Development Kit—is also under development as of this writing. It should be in late beta release by the time you read this.

Developers will be able to choose among many approaches for deploying JavaBeans components. Sun is working with third-party vendors to ensure that bridges to other document-sharing models, such as ActiveX, DSOM, OpenDoc, and CORBA, become available. And the JDK 1.1 will include Remote Method Invocation (RMI), which allows Java components to run in distributed environments across an enterprise.

Like any new software specification, the proof of JavaBeans will be in the implementation. There is no evidence yet that JavaBeans created by different vendors will actually plug into competitors' products, though that's certainly expected. In any case, we'll soon find out, as JavaBeans appear from many vendors, raising the potential for creating rich Web interfaces. JavaBeans have led to a small renaissance in new component-based tools, which will benefit the great majority of Internet users. □

The JavaBean component model emphasizes ease of use, both when a bean is an active component and when it is used inside an application builder.



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PC Tech/Tutor

By Jeff Prosis

Building Applications with Visual C++, Part 1

AppWizard gets the process under way by creating a code skeleton.

Does the thought of writing a Windows application make you quiver with apprehension? Windows programming is notoriously difficult to learn, but today's tools are making it easier. Get acquainted with a programming environment like Microsoft Visual Basic, Microsoft Visual C++, or Borland's Delphi and you can be writing simple to moderately complex Windows applications in no time.

The best way to learn about a programming environment is to write applications with it. In this and the next several installments of Tutor, we'll use Visual C++ to develop a basic Windows application. I'll detail each step of the development process, so you can follow along on your PC (in order to do that, you'll need a PC with Visual C++ 4.x installed). You'll find it easier to follow my lead if you're familiar with C++, but you don't have to be an expert in the language. Even if you're not sure what a virtual function is or

how to derive a class, you can advance your knowledge by studying the examples in this series of columns.

The application we'll create is a variant of tic-tac-toe played on a 5- by 5-square grid. A player wins by lining up four X's or O's horizontally, vertically, or diagonally. The program draws X's and O's on-screen in response to clicks of the left mouse button. Users can save and reload games in progress. As the application comes together, you'll get to know Visual C++ firsthand. You'll also get acquainted with key parts of the Microsoft Foundation Class (MFC) libraries, Microsoft's C++ class library for Windows programming. Finally, you'll gain some insights into Windows itself.

GETTING STARTED

The first step in building a Windows application with Visual C++ is to create a new project and a set of source-code files to go with it. In

the old days, you had to create your source-code files by hand, but today, AppWizard does it for you.

AppWizard is a code generator. When started, it displays a series of dialog boxes asking important questions about the application you wish to write. When you've answered the questions, AppWizard creates a code skeleton that includes the essential elements of the program.

To use AppWizard to create a new programming project, select New from Visual C++'s File menu, click Project Workspace in the ensuing dialog box, and click OK. Then, perform the following steps:

1. In the New Project Workspace dialog, make sure AppWizard is highlighted in the Type box. Then type "Tic" (without the quotation marks) into the Name box. If you'd like the application and its source code to be placed in a directory other than one shown in the Location box, enter the desired path-

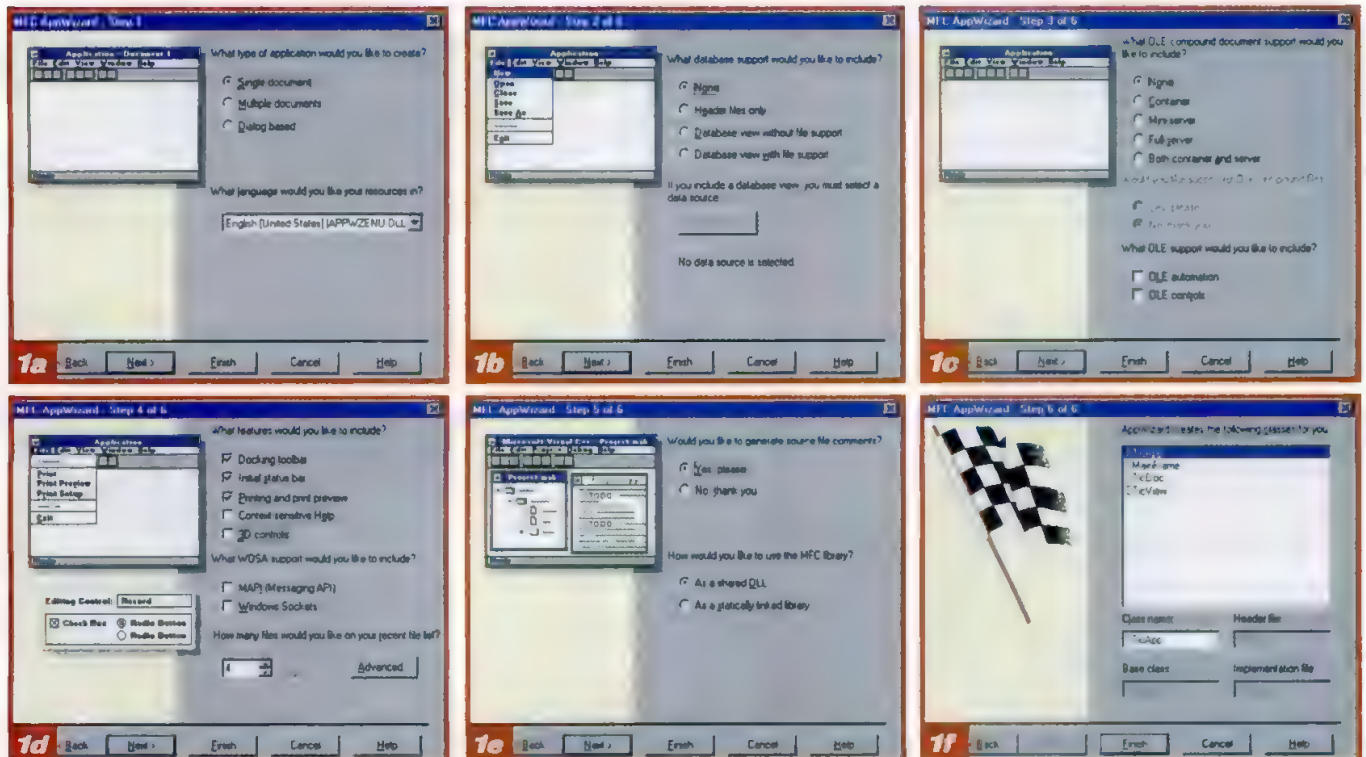


FIGURE 1: This sequence of AppWizard dialogs defines the basic characteristics of our application.

name. When you're done, click the Create button to invoke AppWizard.

2. In AppWizard's Step 1 dialog (see Figure 1a), click Single Document to tell AppWizard you would like to create a single-document-interface (SDI) application. SDI apps allow just one document to be open at a time. AppWizard will also generate multiple-document-interface (MDI) applications, which support multiple open documents. Notepad is an SDI application; Microsoft Word and Excel are both MDI applications. Click the Next button to go to the next dialog.

3. In the Step 2 dialog (Figure 1b), make sure that None is selected under "What database support would you like to include?" Then click Next.

4. In the Step 3 dialog (Figure 1c), select None under "What OLE compound document support would you like to include?" and make sure the OLE Automation and OLE Controls boxes are not checked. Then click Next.

5. In the Step 4 dialog (Figure 1d), check the Docking toolbar, Initial status bar, and Printing and print preview boxes and uncheck all the others. Then click the Advanced button.

6. In the Advanced Options dialog, type "tic" (without quotation marks) into the box labeled File Extension. The application will use .TIC as the filename extension for its documents. Click Close to close the dialog and Next to go to the next one.

7. In the Step 5 dialog (Figure 1e), select Yes, please and As a shared DLL. Then click Next.

8. In the Step 6 dialog (Figure 1f), click the Finish button. AppWizard displays a summary of the files it's about to create in a new dialog. Take a minute to glance over the information and then click OK to allow AppWizard to finish up.

Once AppWizard has finished, you're ready to build (compile and link) the code it has generated. Go to Visual C++'s Build menu and choose Build Tic.exe. When the build is completed, run the application by selecting Execute Tic.exe from the Build menu. A window will appear on your screen. The interior, or *client area*, of the window will be blank. That's because we haven't yet written code to draw anything in the window. The window is called a *frame window*, MFC's term for a top-level window that serves as a container for toolbars, status bars, and other objects.

Even before we add any code of our own, the application is remarkably functional. For example, you can detach the toolbar and drag it across the screen. You can dock it to another side of the frame window, or let it float free in a mini-frame window of its own. The status bar displays context-sensitive help for items in the overhead menu. Many of the menu items work, too.

AppWizard writes the code that creates the menu, the toolbar, and the status bar, but for the most part, it's MFC that makes them

work. Huge chunks of the application's functionality are provided by code hidden inside the class library. That's why AppWizard can do so much with so little. If you were to take away all the extraneous code that AppWizard generates, stripping your program down to the barest essentials, you'd be left with only a few dozen program statements. Writing a similar application without the benefit of MFC could easily require a couple of thousand lines of code.

DOCUMENTS, VIEWS, AND OTHER CLASSES

Before going any further, take a moment to look at the code that AppWizard generated. Somewhere on your screen you should see a window similar to the one shown in Figure 2, called the Project Workspace window. It might be separate from the main Visual C++ window, or it could be docked to the inside. In either case, clicking the small plus sign next to Tic classes displays a list of the AppWizard-generated C++ classes that form the foundation of our application. Clicking the plus sign next to a class name displays a list of the class's function and data members. The list does *not* include function and data members inherited from a base class.

At this point, it's not necessary to understand every line of code that AppWizard generates. It is important, however, to understand the overall structure of the program. Tic is built around five classes, each of which is derived from a base class provided by MFC. The classes AppWizard derived for us are

- *CTicApp*, which represents the application;
- *CTicDoc*, which represents the application's documents;
- *CTicView*, which represents views of the application's documents;
- *CMainFrame*, which represents the application's frame window; and
- *CAboutDlg*, which represents the application's About dialog.

Most of the work we'll be doing will revolve around the document class, *CTicDoc*, and the view class, *CTicView*. In an AppWizard-generated program, data is stored in a document object, and views of the data are rendered by a view object. Documents, views, and other objects are created for you when the application is launched. The physical destination for the view's output is a view window. In an SDI application, the view window overlays the visible part of the frame window's client area. (Think back to the frame window

that resulted when we built the code AppWizard generated.) What looked like the client area—the white area bordered on top and bottom by the toolbar and status bar—is actually a view window.

Our jobs are to flesh out the document class, so the application will have somewhere to store X's and O's; to customize the view class, so it will draw X's and O's on the screen; and to provide a mechanism for letting the document know when a new X or O needs to be added. Our application's data will be an array of bytes containing the contents of each square in the playing grid, and the array will be a data member of the document class. At the appropriate time, the view will query the

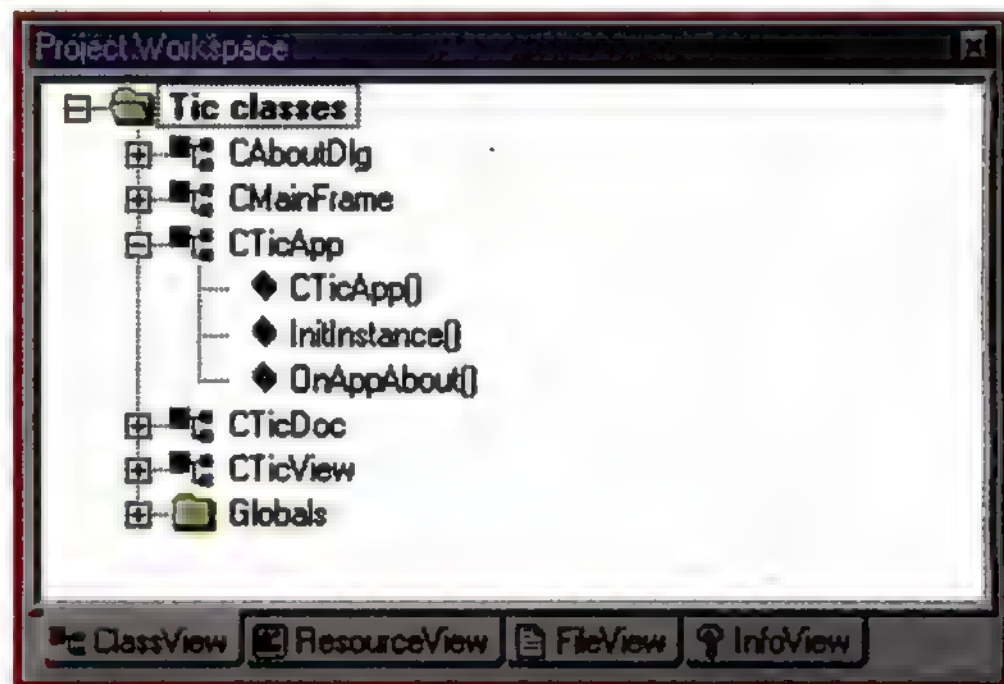


FIGURE 2: Class view of Tic's project workspace, showing *CTicApp*'s member functions.

document for the contents of each square and draw the squares on the screen. It will also add Xs and Os to the document when the user clicks on an empty square.

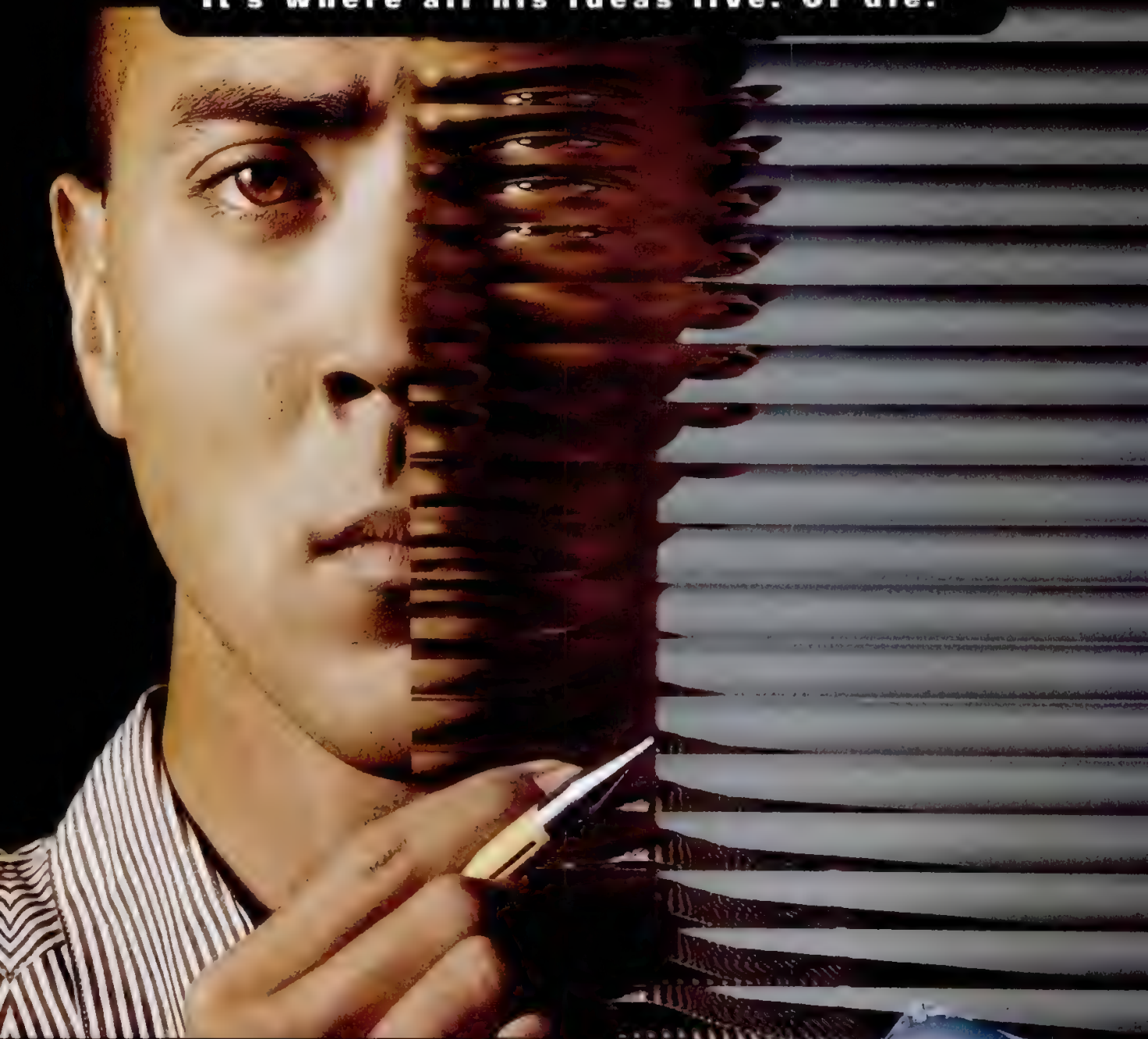
If you're interested in taking a peek at the source code that AppWizard created for any of the classes shown in the Project Workspace window, feel free to do so. You can see the source code for any class member function by double-clicking on its name. Don't despair if the code looks cryptic; AppWizard code looks a little strange to everyone at first. It will be more meaningful to you after you've gained some hands-on experience with Visual C++ and MFC.

COMING UP NEXT

That's it for now. In the next issue, we'll add code that draws the playing grid and that senses mouse clicks. In addition to learning how Windows applications draw to the screen, you'll be introduced to another handy Visual C++ programming tool called ClassWizard, which picks up where AppWizard leaves off. ClassWizard simplifies the chores of deriving new classes, adding function and data members to existing classes, and more. Stay tuned. □

Jeff Prosise is a contributing editor of PC Magazine.

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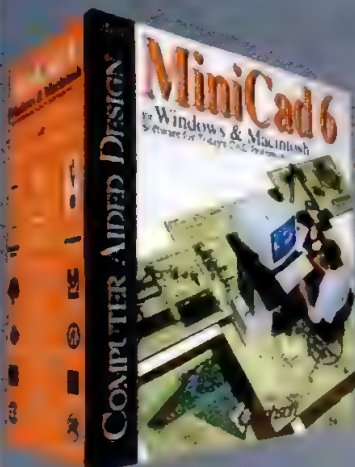
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PC Tech/Power Programming

By Zan Oliphant

Plug-Ins for Netscape Navigator

Extend Navigator *and* Internet Explorer using the Plug-In API.

In January of 1996, Netscape Communications Corp. introduced a new API along with the beta release of its Navigator 2.0 browser. The Netscape Navigator Plug-In API gave developers the ability to expand Navigator's MIME support to cover data types yet to be invented, in addition to those already existing, through plug-in modules. Navigator plug-ins were quickly accepted by the development community, and many major companies, such as Adobe Systems and Macromedia, rushed to create plug-ins to support their proprietary file formats.

Today you can cover well over 90 percent of the Web browser market by developing extensions for Navigator and Microsoft Internet Explorer. And since both browsers support Netscape's Plug-In API—while only Internet Explorer supports Microsoft's ActiveX technology—Navigator plug-ins are the safest bet for extending most Web browsers. In this article, we'll show you how the Netscape plug-in interface works and present a sample project.

MIME TYPES

Today's browsers rely heavily on Multipurpose Internet Mail Extensions (MIME). As its name implies, the MIME standard was created for supporting data types in electronic mail. With support for images, audio, video, binary data, fonts, and text, MIME was a natural for extending the Web's HyperText Markup Language (HTML). An HTML document is also represented by the text/html MIME type, where *text* specifies the type and *html* specifies the subtype.

On a local machine, a MIME type is usually associated with one or more file extensions. For HTML files, these extensions are .HTML and .HTM. When you open a file on your local machine, the MIME type is determined by the association set for the file's extension. But when you open a location on the Web, the MIME type is determined by the Web server, and the file is sent to your browser using the HyperText Transmission Protocol (HTTP). Many first-time Navigator plug-in developers can't understand why a plug-in that works fine with

data files on a local machine will not work on a MIME type coming from a Web server. That's because the problem is at the other end: The HTTP server does not recognize a new MIME type. The solution? Add the new type to the server, or use an existing type.

A Navigator plug-in is mapped to a given MIME type through the plug-in's version resource information. The relevant resource keys are `MIMEType` and `FileExtents`, which define the plug-in's MIME type and that type's file extension. When Navigator is launched, it enumerates the files in a subfolder called `Plugins` and queries each plug-in for its MIME type, description, and suffixes. Only files that start with `NP` are queried, so be sure to begin your plug-in's name with `NP`. No plug-in code

Netscape came up with the `<EMBED>` tag, so that HTML authors could easily bring in a plug-in to display a new data type. When Navigator sees the tag, it executes the associated plug-in. Among other attributes, the `<EMBED>` tag supports `src`, `width`, and `height` to specify the plug-in's source file and window size. Because several other attributes are defined—and more are being added—you should keep tabs on Netscape's plug-in documentation at its Web site for future updates.

In Windows, plug-ins are implemented in Dynamic Link Libraries (DLLs). A Windows plug-in DLL has only three official library entry points: `NP_GetEntryPoints`, `NP_Initialize`, and `NP_Shutdown`, defined as ordinals 1, 2, and 3, respectively. Savvy readers will notice that `NP_GetEntryPoints` must lead to more plug-in entry points. It does, but not in the normal Windows fashion. Netscape, in the interest of portability, departed from standard Windows DLL design and allowed for calling of plug-in code directly by Navigator through function pointers. This design simplifies cross-platform code for both Navigator and plug-ins. Plug-in-implemented entry points, or *methods*, as Netscape calls them, are prefaced with `NPP_` and currently include:

```
NPP_Destroy
NPP_DestroyStream
NPP_GetJavaClass
NPP_HandleEvent
NPP_Initialize
NPP_New
NPP_NewStream
NPP_Print
NPP_SetWindow
NPP_Shutdown
NPP_StreamAsFile
NPP_WriteReady
```

Navigator-implemented plug-in methods, prefaced by `NPN`, include:

```
NPN_DestroyStream
NPN_GetJavaEnv
NPN_GetJavaPeer
NPN_GetURL
NPN_GetURLNotify
```



FIGURE 1: Our sample plug-in uses Windows' `MCIWnd` class to handle several media types. Sliders are provided for seeking, which allows users to randomly scan through media, and the video window has controls for scaling, volume, and speed.

is loaded at this time. Once Navigator is running, you can see what plug-ins are available by selecting the `Help | About Plug-ins` menu item, which displays all active plug-ins. If you don't see your newly developed plug-in in that list, you may be missing a resource key, or you didn't begin the filename with `NP`.

A plug-in is not loaded until the browser needs it to display an add-on MIME type.


```
NPN_MemAlloc
NPN_MemFlush
NPN_MemFree
NPN_NewStream
NPN_PostURL
NPN_PostURLNotify
NPN_RequestRead
NPN_Status
NPN_URLNotify
NPN_UserAgent
NPN_Version
NPN_Write
```

As the method names make clear, plug-ins use a streaming design, support Java integration, and can request and communicate with specific URLs. Other goodies include memory and instance management methods, status methods, and window and printing methods. Before you abandon your plug-in project at the thought of all those methods, let's take a look at a simple example—a really cool multimedia plug-in written for Windows 95.

A MULTIMEDIA PLUG-IN

Windows 95 includes a window class called MCIWnd, a part of the operating system that supports a variety of media types, including AVI video, WAV audio, and MIDI. With MCIWnd and just a few pages of code, you can create a Navigator plug-in that supports these same types. The code samples in this article have been pared down for brevity and should *not* be used verbatim. You can download all of the source code from PC Magazine Online (see the sidebar "Getting the Files," in this issue's Utilities column). The project was created with Microsoft Visual C++ 4.0.

The first thing you need to do is to get Netscape's Plug-In SDK, if you haven't already. The SDK includes header files, examples with source code, documentation, and a Java runtime interface. It is available free of charge from Netscape's Web site (*home.netscape.com*). For this example, you need only the header files.

After you get the SDK, create a new project with Visual C++. Begin the project name with NP and create a Windows DLL without using the Microsoft Foundation Classes (MFC). Avoiding MFC reduces a plug-in's size considerably, saving download time for your prospective users.

Once the DLL is created, insert a version resource into your project. Change the block-header properties' code page to Windows Multilingual by double-clicking on the Block Header box. You can add the plug-in-specific resource information directly to the version resource by opening the .rc file as text and adding the resource keys MIMEType, FileExtents, and FileOpenName. For this example, the added resource entries look like this:

```
VALUE "MIMEType",
"video/x-msvideo|audio/
x-wav|audio/x-midi\0"
VALUE "FileExtents", "avi|wav|mid\0"
VALUE "FileOpenName", "Video
(*.avi)|Audio (*.wav)|MIDI (*.mid)\0"
```

Our plug-in supports three MIME types for video, audio, and MIDI, with the associated file extensions .AVI, .WAV, and .MID. The resource key FileOpenName tells Navigator what text to display for a given MIME type in its File | Open dialog. Vertical bars are used to separate each MIME type, extension, and name.

Now that your resource information is squared away, create a class—CMCIWnd—for handling MCIWnd. This class contains the private member hMCIWnd, a handle to the MCIWnd window, along with the public member hNavigatorWnd, a handle to the Navigator-created plug-in window. Public methods GotFileName and UpdateWindow are defined, along with the standard constructor and destructor:

```
class CMCIWnd
{
private:
    HWND    hMCIWnd;
public:
    HWND    hNavigatorWnd;
    CMCIWnd ();
    ~CMCIWnd ();
    void GotFileName (const char* fname);
    void UpdateWindow (HWND hwnd);
};
```

Because this example shows a simple file-based plug-in, as opposed to a more complicated streaming-based plug-in, we need only the single method GotFileName to tell the plug-in object when a data file has been completely downloaded to the local machine. (A *streaming* plug-in processes data from a source file as it is being downloaded from the Web server. This type works well for high-bandwidth, real-time data types, such as audio and video. A *file-based* plug-in waits until an entire file is downloaded before doing any processing—a technique more suitable to document-viewer plug-ins, which usually require a whole file.) The method UpdateWindow allows the media window to repaint itself.

After completing the plug-in's central class, you need to write at least skeletal code for all plug-in-implemented methods, those prefaced with NPP_. They can be seen in npshell.cpp. Our plug-in uses seven of the plug-in-implemented methods and none of the Navigator-implemented methods, those prefaced with NPN_.

Each time Navigator encounters an <EMBED> tag with your plug-in's associated MIME type, it calls the plug-in-defined method NPP_New, which allows the plug-in to cre-

ate a new instance of itself in order to handle the type data. In our example, the new operator is used to create a new CMCIWnd object, which is then attached to the Navigator-maintained instance pointer, pInstance->pdata. Navigator will pass the instance pointer back to the plug-in during future calls to a specific instance:

```
NPErrror NP_LOADDS NPP_New (NPMIMEType
    pluginType, NPP pInstance,
    uint16 mode, int16 argc, char* argn[],
    char* argv[], NPSavedData* saved)
{
    // Create a new CMCIWnd object

    CMCIWnd* pMCIWnd = new CMCIWnd ();

    // Attach it to the instance structure

    pInstance->pdata = pMCIWnd;

    return NPERR_NO_ERROR;
}
```

Most plug-ins have an associated window that is a child of Navigator's main window, created by Navigator using dimensions specified in the <EMBED> attributes. Many plug-ins use a Windows programming technique called *window subclassing* to manage the plug-in window. Our example, however, creates a whole new child window that overlays the original plug-in window. Regardless of which technique you use, Navigator calls the NPP_SetWindow method to notify your plug-in of its window handle and any subsequent requests to update the window. In the following code you can see where our plug-in retrieves the window handle on the first call and updates its child window on future calls. Also notice how a pointer to the CMCIWnd object is retrieved from pInstance->pdata:

```
NPErrror NP_LOADDS NPP_SetWindow
(NPP pInstance, NPWindow* window)
{
    CMCIWnd* pMCIWnd =
        (CMCIWnd *)pInstance->pdata;

    // Get Navigator's window handle

    if (window->window)
    {
        if (!pMCIWnd->hNavigatorWnd)
            pMCIWnd->hNavigatorWnd
                = (HWND)window->window;
        else
        {
            pMCIWnd->UpdateWindow (pMCIWnd->
                hNavigatorWnd);
        }
    }
    return NPERR_NO_ERROR;
}
```

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Before Navigator starts to download the MIME source file, the plug-in is offered a chance to process the file in a streaming fashion in the `NPP_NewStream` method. A plug-in that wants to process data on the fly would set the `*stype` pointer to `NP_NORMAL` (the default). This example uses `NP_ASFILEONLY`, a new type compatible with Navigator 3.0 and above. `NP_ASFILEONLY` prevents any calls to the streaming methods `NPP_WriteReady` and `NPP_Write`. Navigator 2.0 used a type called `NP_ASFILE` that is not as efficient as `NP_ASFILEONLY`. If you use `NP_ASFILE`, be aware that Navigator will stream the data file in all cases—even on a local file. `NP_ASFILEONLY` streams only remote files. (Streaming in Navigator involves reading a file and writing it to local cache, then passing the name of the cached file to the plug-in.)

```
NPError NP_LOADDS NPP_NewStream
(NPP pInstance, NPMIMEType type,
 NPStream* pStream, NPBool seekable,
 uint16* stype)
{
 *stype = NP_ASFILEONLY;
 return NPERR_NO_ERROR;
}
```

Once the source file being handled by the

plug-in is completely downloaded to the local machine, Navigator calls the plug-in-implemented method `NPP_StreamAsFile`. This method gives a plug-in the name of the file on the local disk. The data file will usually reside within Navigator's cache directory, with an obscure filename such as "M0p64tdc.avi." In the following code, you can see how our plug-in retrieves its instance pointer and calls `GotFileName` to process the local file:

```
void NP_LOADDS NPP_StreamAsFile (NPP
 pInstance, NPStream* stream,
 const char *fname)
{
 CMCIWnd* pMCIWnd =
 (CMCIWnd *)pInstance->pdata;

 if (pMCIWnd)
 pMCIWnd->GotFileName (fname);
}
```

Within the `CMCIWnd` class, the `GotFileName` method turns over the filename to the Windows API function `MCIWndCreate`, which creates an `MCIWnd` window. Here the plug-in passes `MCIWndCreate` a parent window and `NULL` for the window style. Using `NULL` with a parent window causes the function to use its default child window styles: `WS_CHILD`, `WS_`

`BORDER`, and `WS_VISIBLE`. The return value is a handle to the window, which is saved in `CMCIWnd::hMCIWnd`.

```
void CMCIWnd::GotFileName
(const char* fname)
{
 // Open the MCIWnd file

 hMCIWnd = MCIWndCreate
(hNavigatorWnd, 0, NULL, fname);
}
```

A plug-in instance is destroyed when the user goes on to another Web page or when Navigator is closed. The plug-in is notified of the instance destruction with a call to its `NPP_Destroy` method. In our sample, the plug-in retrieves its instance pointer and destroys the `CMCIWnd` object using the `delete` operator. The object destructor calls `MCIWndDestroy` to clean up the media window. `MCIWndDestroy` is a Windows macro that sends a `WM_CLOSE` message to the given MCI window.

```
NPError NP_LOADDS NPP_Destroy
(NPP pInstance, NPSavedData** save)
{
 CMCIWnd* pMCIWnd = (CMCIWnd *)
 pInstance->pdata;
```

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```
if (pMCIWnd)
delete pMCIWnd;

return NPERR_NO_ERROR;
}

CMCIWnd::~CMCIWnd()
{
if (hMCIWnd)
MCIWndDestroy (hMCIWnd);
}
```

SEE HOW IT RUNS

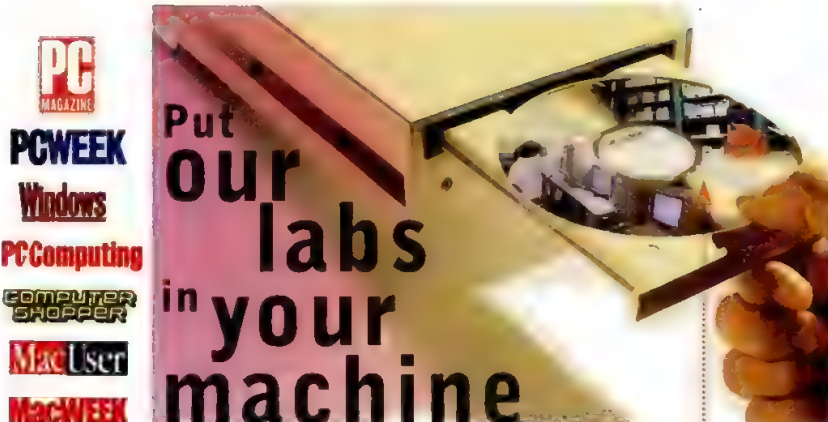
Our sample, despite its simplicity, is entertaining to play with. As you can see from Figure 1, there are sliders for seeking, which allows users to scan randomly through media. The video window has controls for scaling, volume, and speed. You can even copy an image to the clipboard or send a string to the MCI device. All of this functionality is provided by the MCIWnd class. The plug-in glues Navigator together with built-in Windows MCI features. Looking at Figure 1, you'll see three different MIME types open at the same time—an example of a plug-in with three instances of itself running. That means NPP_New has been called three times and the plug-in has allocated three separate CMCIWnd objects.

Take a look at the HTML code that results in the screen in Figure 1. Notice the three <EMBED> tags with associated source files: sample.avi, outofb.wav, and canyon.mid. Also note how each window size is specified by the width and height attributes.

```
<html>
<body>
<Body Background="blue_pap.gif">
<h1 align=center>MCIWnd Based Plug-
in</h1>
<h2 align=center>Video</h2>
<center><p><embed SRC=sample.avi
WIDTH=322 HEIGHT=268></p></center>
<h2 align=center>Wave Audio</h2>
<center><p><embed SRC=outofb.wav
WIDTH=300 HEIGHT=28></p></center>
<h2 align=center>MIDI</h2>
<center><p><embed SRC=canyon.mid
WIDTH=300 HEIGHT=28></p></center>
</body>
</html>
```

There you have it. A Netscape Navigator plug-in written in less than 100 lines of code with support for AVI video, WAV audio, and MIDI. The resultant plug-in DLL is less than 25K in size, and it works under Internet Explorer as well as Navigator. □

Zan Oliphant is a software consultant and the author of Programming Netscape Plug-ins (Sams.net Publishing, 1996; ISBN: 1575210983). You can reach him at zan@gate.net.



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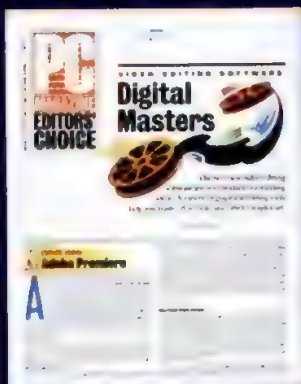
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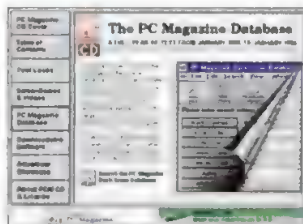
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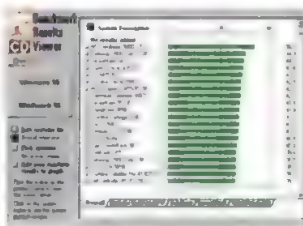
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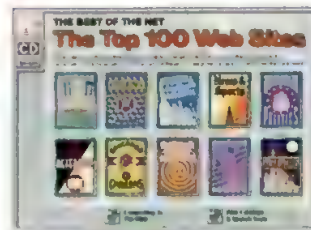
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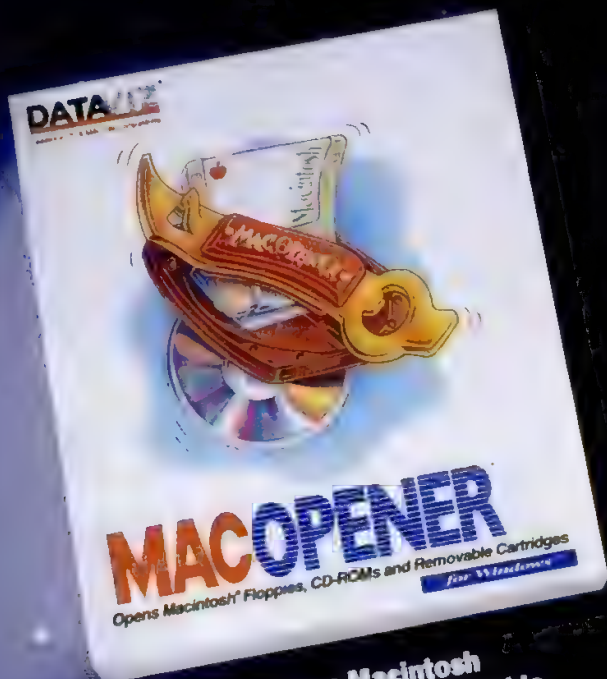
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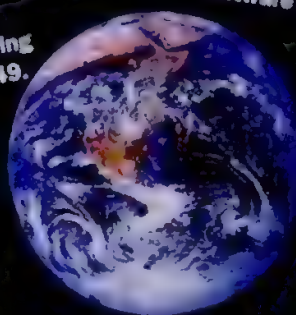
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By Steve Rigney

Windows NT Server 4.0: Internet Features

Microsoft's powerhouse OS offers a total Internet/intranet package.

Depending on which surveys you read, it seems as though corporate intranets are going to explode in the next few years. Every LAN will add a Web server and use browsers to perform most tasks, such as word processing, database access, and accounting. Unfortunately, it is impossible to predict whether everyone—especially administrators of small LANs—will actually jump onto the intranet bandwagon or will simply stick with their existing file and print servers and multiple client applications.

If you do decide to create a corporate intranet or to connect your LAN to the Internet, Microsoft Windows NT Server 4.0 is probably the best way to do it. With features like administrative wizards, strong security, and enhanced performance, Windows NT 4.0 has everything you need in a powerful file and print server. With the addition of features such as built-in Web, gopher, and FTP servers, a Web browser, a Web page editor, remote access, a multiprotocol router, a DNS server, and support for Point-to-Point Tunneling Protocol and Multilink PPP, Windows NT 4.0 is even more powerful as an intranet server.

Windows NT retails for \$809 for a single server license and five clients. This price is a good deal if you plan to use all of the intranet features included. For example, a comparable Web server, such as Netscape's Enterprise Server, retails for \$995, and you'll still need an OS (such as Windows NT) on which to run it. Microsoft is not the only vendor to bundle intranet applications with an OS. Novell's new IntranetWare includes the NetWare 4.11 OS, plus a Web server, a multiprotocol router, and an IPX-to-IP gateway.

INTERNET INFORMATION SERVER

The most obvious Internet/intranet application in Windows NT Server 4.0 is the Internet Information Server (IIS), Version 2.0. In addition to the HTML Web server, IIS also includes a Gopher and an FTP server. You can view and configure all of the Web, Gopher, and FTP

servers running on your corporate intranet using the Internet Service Manager (Figure 1).

IIS is extremely easy to set up and use, but it lacks some administration features. Administrators can remotely connect to the IIS using any browser, but the tasks that can be performed are limited. For example, you can't change the container information where your Web data is stored.

All of the servers in IIS are tightly integrated with the Windows NT access control security. IIS uses the same security information you set up for your local Windows NT users to control access to the intranet server. IIS also works with Secure Sockets Layer (SSL), Version 2.0. The folks at Microsoft are still working on support for SSL, Version 3.0.

To help you create your own Web-based applications, IIS includes the Microsoft ISAPI (Internet Server API) extensions, which also let you use third-party ISAPI applications. For creating less sophisticated Web applications, IIS supports CGI scripts, which you can write in such languages as Visual Basic and Perl.

IIS also includes an Internet Database Connector (IDC), a tool that allows you to share your existing database information with users on the Web. IDCs will automatically retrieve information from any ODBC-compliant database (such as Microsoft Access, Microsoft

SQL Server, Oracle SQL Server, and Informix) and convert the information into HTML format. Currently, IIS includes the IDC connector for only Microsoft SQL Server, but you can download other ones at no charge as they become available.

Though not bundled with the OS, one of the most powerful features of IIS is the Microsoft Index Server. You can download this application and use it to index all of the information located in your Web container directories. The unique feature of the Index Server is its ability to search Microsoft Word, Excel, and PowerPoint documents, in addition to HTML and plain-text documents. The Index Server is also multilingual and can search in seven languages. You can search using single key words or use Boolean logic to find documents that include multiple words or phrases in a certain order. The search engine performs automatic updates of the index as new documents are added or changed. The Index Server is integrated with Windows NT security to prevent users from searching or viewing information to which they don't have access.

FRONTPAGE AND INTERNET EXPLORER

The Microsoft FrontPage development tool (Figure 2), which comes bundled with Windows NT, allows you to create HTML-based Web pages easily. With FrontPage, you don't need to learn HTML commands, and if you can use a word processor, you can create Web pages. FrontPage also includes wizards that walk you through every step of designing a Web page. Our favorite feature of FrontPage is its ability to keep track of binary files associated with hyperlinks. When you create a link to a graphic or a file, FrontPage automatically locates that file and copies it into the Web server container directory.

To complete its Web server solution, Windows NT Server 4.0 includes a copy of Microsoft Internet Explorer 3.0, which is quickly gaining ground on the Netscape browser standard, and supports ActiveX, Java, and most other advances in Web technology.

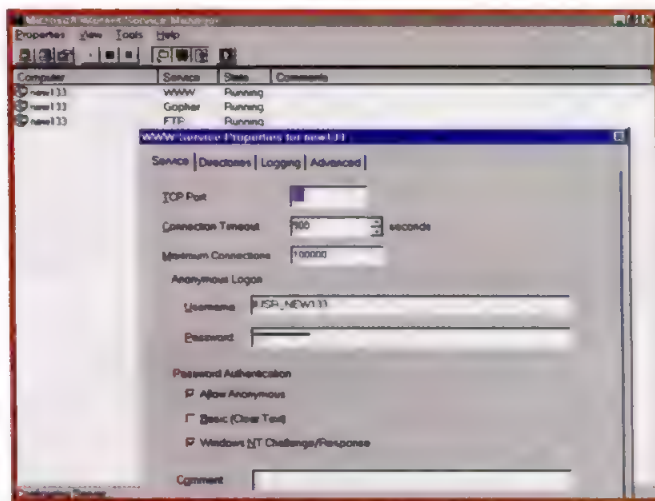


FIGURE 1: The Microsoft Internet Service Manager allows you to configure all of the Web, Gopher, and FTP servers running on your corporate intranet.

REMOTE-ACCESS SERVICES

As most network administrators know, an intranet is a limited resource unless you have a way for remote users to connect to it. Windows NT handles this need with its built-in RAS (Remote Access Services) application. RAS is not new to Windows NT, but it is an important part of Microsoft's Internet/intranet solution.

RAS is a remote-node server that allows you to connect to a remote LAN using analog modems, ISDN, X.25, and digital WAN links. RAS works with the TCP/IP, IPX, and NetBEUI protocols. You can connect to RAS using the RAS client in Windows for Workgroups, Windows 95, and Windows NT, or using any PPP client software on any platform. Although RAS is a powerful remote-access server, two new features, Multilink PPP and PPTP, make it ideal for Internet/intranet connections.

Multilink PPP allows you to combine or aggregate two physical communications links to increase performance. For example, you can use two analog modems or two ISDN B-Channels to effectively double your connection speed to the Internet/intranet. You can even combine mixed analog with ISDN connections. This is a great way to increase performance without paying for expensive digital

the IP network. For example, you can send NetWare IPX packets over the Internet. PPTP treats your local corporate network as a PSTN (Public Switched Telephone Network) ISDN or X.25 virtual WAN, and public carriers, including the Internet, know how to work with these virtual connections.

The most common use of PPTP is to create a Virtual Private Network (VPN) over the Internet. For example, you can establish a PPTP connection with an ISP and use the Internet to gain secure access to all of the resources on your corporate LAN. Obviously, this requires your ISP to use a PPTP access server, such as Windows NT RAS. Your corporate network must also have a RAS server directly connected to the Internet. All of the data you send and receive is encrypted using an RSA RC4 40-bit session key negotiated at connection time. Microsoft is also working on a 128-bit session key that will be available for use in the U.S. To provide even more security for your VPN, PPTP uses Password Authentication Protocol and Challenge Handshake Authentication Protocol.

One of the biggest advantages of PPTP, besides convenience, is low cost. Because you are using the Internet to allow remote users and networks to access your local network,

you don't have to pay for expensive modem pools, analog phone lines, or access servers. All of your telecommuters and road warriors can use an inexpensive ISP connection to access the corporate network, and you only have to establish a single high-speed Internet connection for the RAS server.

VPNs sound like a great idea, but most network administrators may still be concerned about security. Fortunately, a feature called *PPTP filtering* can protect your network from Internet-

based attacks. To use PPTP filtering, you need at least two network adapters in your RAS server: one for the Internet connection and the second for access to the corporate network. When you enable PPTP filtering on a network adapter, only PPTP packets can get in. Once the PPTP packets reach the server, the encryption key determines whether the packets can access the corporate network, and the second card performs all of the routing. To be extra safe, you might want to use only the IPX or NetBEUI protocols on your corporate LAN and reserve IP for your RAS servers. This technique is similar to establishing an Internet firewall.

MULTIPROTOCOL ROUTER

Windows NT Server includes a multiprotocol router that allows you to connect LANs and WANs that use different network protocols and topologies, such as Ethernet and Token Ring. Every network packet that travels across a LAN contains a header that includes its source and destination addresses. A router can look at the header and determine where the packet came from, where it is going, and the best path to get it there.

For example, if you have multiple networks and multiple links between them, a router can determine whether a packet needs to travel across the expensive high-speed links and, if it does, the best route to take. This way, a router can increase performance and save you money.

DNS SERVER

Microsoft offered a DNS server for earlier versions of Windows NT, but unfortunately, the product was not bundled with the OS, and it was extremely complicated to install and configure. Windows NT Server 4.0 includes a new and improved DNS server that is fairly easy to install and provides tight integration with the OS. Microsoft's DNS server also works closely with Dynamic Host Configuration Protocol (DHCP) and Windows Internet Name Service (WINS). DHCP allows you to assign IP addresses to host systems automatically, and WINS provides a database of host names that are mapped to IP addresses. This allows you to use "friendly" host names instead of IP addresses to map to network resources.

The best new feature of the Windows NT DNS server is the DNS Manager application. DNS Manager is a graphical utility that lets you manage all of your local and remote DNS servers and their databases. You can use the manager to administer an entire domain, which is broken down into subdomains called *zones* and *subzones*. This allows you to integrate your Windows NT network domains with your DNS domain server. For example, an ISP can use the DNS Manager to set up separate domain names for different networks that use its service.

Dozens of Web servers, remote-access solutions, HTML editors, and routers provide more features than the ones included with Windows NT Server 4.0. But the Internet/intranet features in Windows NT are free and probably more than adequate for most corporate networks. The tight integration between the OS and the intranet applications is also a major selling point. Windows NT started life as a file and print server, and those capabilities are still a major part of the product. But now that everything you need to set up an intranet comes in a single box, Windows NT Server 4.0 is more impressive than ever. □

Steve Rigney is a contributing editor of PC Magazine.

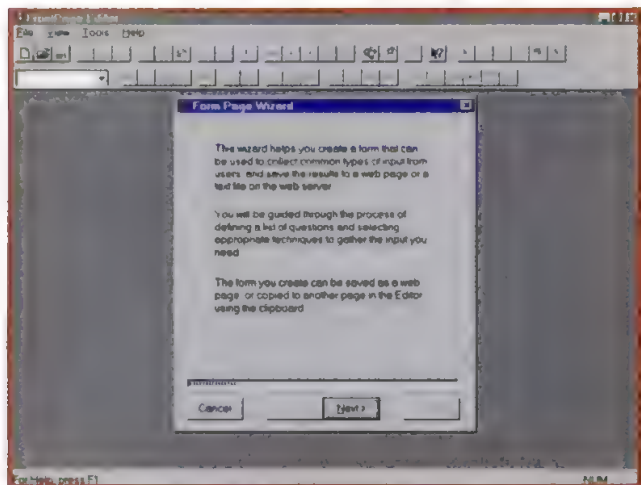


FIGURE 2: The Front Page editor includes wizards that help you create your HTML documents.

leased connections. Unfortunately, you cannot add bandwidth on the fly, and you will have to connect all of your devices from the start to get the added performance. Note that Multilink PPP will work only if both your client software and your access server support the standard.

In the most basic sense, PPTP, or Point-to-Point Tunneling Protocol, allows you to use the Internet to establish a secure, low-cost connection to your corporate network. PPTP can route PPP packets over any IP network. Because PPTP tunnels, or encapsulates, multiple protocols (including IP, IPX, and NetBEUI), you can send any type of packet over

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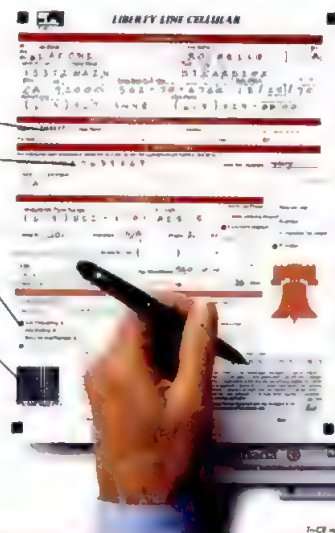
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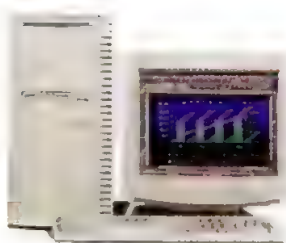
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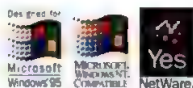
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PC Tech/Utilities

By Douglas Boling

URL Tracking Made Easy

ClipAid lets you snip and save the URLs you want to keep.

How many times have you scribbled a cool-sounding URL (Uniform Resource Locator) on a scrap of paper, only to discover when you entered the URL in your browser that you copied it incorrectly? Wouldn't it be nice if there were a better way to keep track of URLs? With this issue's utility, ClipAid, there is.

ClipAid, which runs under Windows 95 or Windows NT 4.0, makes it easy to clip and store URLs. All you need to do is copy the URL into the clipboard. ClipAid monitors the clipboard and saves URLs in a history list. You can also configure ClipAid to insert a URL data type automatically into the clipboard along with the URL text. This lets you paste the URL to your desktop or a folder as an Internet shortcut. When you double-click on this shortcut, the system will automatically launch the Internet access software you have associated with the URL data type: your Web browser, for example, if the URL points to a Web page, or your mail program, if the URL is someone's Internet mail address.

You can obtain ClipAid by mail or by downloading it from PC Magazine Online. Refer to the sidebar "Guide to Our Utilities" for details. The source code for ClipAid, which was written with Microsoft Visual C++ 4.1 and the Microsoft Foundation Classes (MFC), is also provided, for those interested in seeing how it works.

USING CLIP AID

To install ClipAid, just copy Clipaid.exe into a directory on your hard disk and create an icon for it in your shell. When you launch ClipAid, you'll see a small icon in the tray at the far end of the Taskbar. As long as ClipAid is running, any URL that you copy into the clipboard will be saved in the ClipAid history list. ClipAid supports the following Internet

schemes: http, ftp, file, gopher, mailto, news, and telnet.

To view the URLs you've saved, double-click the ClipAid icon on the Taskbar. The ClipAid window, organized as a set of property sheets, will be displayed on your screen (see Figure 1). The property sheet initially displayed is the history page, which contains a list of the last 64 Internet addresses you have copied to the clipboard. ClipAid automatically removes duplicates, so the list contains up to 64 unique addresses in the order in which they were saved, with the most recent at the top.

If you double-click on an address in the list

IN THIS ISSUE

ClipAid

Using the clipboard, ClipAid gives you an easy way to store and retrieve URLs as well as to create Internet shortcuts for URLs.



or click the Copy button, ClipAid will copy the selected URL back into the system clipboard. Since ClipAid knows the copied data is a URL, it will place not only the URL text string into the clipboard but also a set of other data types recognized by Explorer. That lets you paste an Internet shortcut onto the Windows desktop or into a folder. When you double-click on the shortcut, the system will automatically launch the Internet access software you have associated with its URL data type.

Two other buttons on the history page help you manage the history list. The Delete but-

ton deletes a selected URL from the list, and the Clear History button clears the entire list. To protect against accidents, ClipAid asks for confirmation before clearing the list.

ClipAid's Configuration page contains a set of radio buttons that let you control whether ClipAid automatically inserts the URL data type into the clipboard when you copy a URL, and, if so, how that is handled. To help you understand these options, I'll start with a quick tutorial of how the clipboard works.

The clipboard can hold only one item at a time, but it can hold different versions of the same item simultaneously. For example, if you cut a line of text from Microsoft Word into the clipboard, Word copies, among other things, the simple ASCII text, the version in Rich Text Format (RTF), and the text with OLE object information, along with many other data types. In fact, Word copies enough information to allow the clipboard to provide text in 12 different formats. That lets another program use the text representation that best suits its needs.

One of the types Word does not copy to the clipboard is the URL data type used by Internet Explorer. ClipAid can insert the URL data type into the clipboard, along with a few others and the original text, so that Explorer can create an Internet shortcut for pasting into a folder or onto the desktop. You can configure ClipAid to do this for you automatically or whenever you copy a URL into the clipboard, or you can do it manually, as needed.

Unfortunately, inserting the URL data type overwrites other data types that OLE-enabled programs, such as Word or Excel, use to handle OLE objects. For that reason, ClipAid lets you control the automatic insertion of the URL into the clipboard.

How and when ClipAid inserts URL data into the clipboard is controlled by a group

FOR PROGRAMMERS ONLY To learn about the data types needed to create ClipAid, author Doug Boling wrote a program to spy on the clipboard. The secrets he uncovered give ClipAid its power. The full source code for ClipAid, which was written in C++ with the Microsoft Foundation Classes (MFC), is available from PC Magazine's Web site, along with this article. ClipAid demonstrates

- which data types you need to create an Internet shortcut;
- how to use MFC and OLE to insert a new data type into the clipboard; and
- how to use a property sheet as the main window for an application.

Help for PC Magazine's free utilities can be obtained in our online discussion areas, both on the World Wide Web (www.pcmag.com/discuss.htm) and on ZD Net in the Utilities section of ZD Net's TIPS Forum (GO ZNT:TIPS). The authors of current utilities generally visit this forum daily. You may find an answer to your question simply by reading the messages posted in the forum. If the author is not available and the forum sysops can't answer your question, the Utilities column editor, who checks this forum each day, will contact the author for you.

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of radio buttons labeled Clipboard Safety, on the Configuration page. The first of the four buttons, Always Insert URL Data Type, tells ClipAid always to put the URL data type in the clipboard when a new URL is added to the list. This setting is handy if you are using non-OLE programs, since the URL insertion always occurs automatically. It is also the only mode that retains formats in the clipboard that are not known to ClipAid when inserting the URL data type. Use this mode if you want automatic insertion when running programs that use special text formats, such as a Netscape Navigator bookmark data type. Since the inserted URL data type can cause problems when using the OLE features of programs like Word and Excel, this mode is not a good option when using these programs.

The second setting, Insert URL Data Type And Delete All But Text And RTF Types, configures ClipAid to copy a URL data type automatically to the clipboard but to delete all data types other than text and, if available, RTF. Since basic formatting information is retained with the RTF data type, you can cut and paste within programs like Microsoft Word or WordPad as long as you are working with text and not OLE objects. Deletion of the other data types prevents the word processor from attempting to use OLE when it cannot. Special-purpose data types that are unknown to ClipAid are also deleted. This option is the best choice when cutting URLs from word processors.

The third setting, Insert URL Data Type Only When Simple Text Is In Clipboard, causes ClipAid to place a URL data type in the clipboard only when the clipboard contains the standard ASCII text data type, and no other. This setting is safer than the two settings listed above but can be inconvenient when you are using an OLE-enabled program, such as Word. This option is useful if you are using a program like Notepad or most Internet e-mail programs, which only insert the text data type into the clipboard.

The final setting, Never Place URL Data Type, disables automatic URL insertion under all conditions, although ClipAid will continue to add the URL text to its history list. You can insert the URL data type manually by double-clicking on a URL or by selecting a URL and clicking the Copy button.

Below the radio buttons are two check boxes. Check the first box, Allow Single Click Activate From Taskbar, and ClipAid will open with a single click on its Taskbar icon instead of a double-click. (That's not the way Microsoft's own tray icon utilities work, but many users like the quick response of single-click activation.)

Checking the other check box, Start ClipAid Each Time Windows Is Started, lets you start ClipAid automatically without placing

it in your StartUp group. ClipAid uses few resources and its performance impact is minimal, so you'll probably want to use this option. Since ClipAid saves the history list when you exit and restores the list when you restart the program, the list can contain URLs you saved weeks or months ago.

The Configuration page also contains a Remove button, which shuts down ClipAid and removes it from memory. This is different

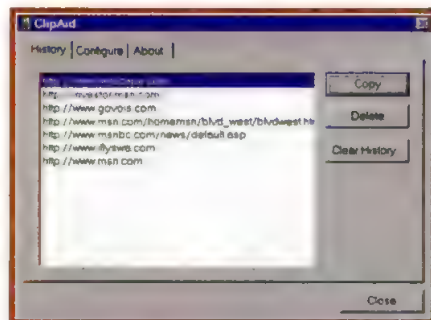


FIGURE 1: Double-click on an item in ClipAid's history list to copy that item to the clipboard.

from the Close button, which minimizes ClipAid but does not remove it from memory. Note that ClipAid must be running and visible in the Taskbar in order to monitor the clipboard and save URLs in its history list.

The last page of the ClipAid window is the About page, which contains information on the current version, the author, the copyright, and the basic system, including the operating system version and the CPU type.

That covers the ClipAid window settings. But there are some other useful actions available by right-clicking on the ClipAid icon in the tray. The first item on ClipAid's context menu is Properties; selecting it displays the ClipAid window. If there are any URL addresses in the history list, the context menu also displays the last four that you copied into the clipboard. When you select one of these menu items, ClipAid copies the URL into the clipboard, so you can paste it as a shortcut. This provides a quick method of inserting the URL data type into the clipboard even if ClipAid is not configured to do that automatically.

INSIDE CLIP Aid

ClipAid represents a departure from my usual practice of writing *PC Magazine* utilities in C. For years, I have resisted the move to C++ and its associated class libraries because of the lack of portability across different compilers. But the emergence of ever more complex Windows APIs, such as OLE, has made programming in C much more difficult. A class library such as MFC shifts many burdens from the application programmer to the class library programmer.

Though ClipAid is a fairly simple utility, it does make some minimal use of OLE. Instead

of supporting a vast set of OLE interfaces just to copy one data type into the clipboard, I chose instead to use MFC. Indispensable in this task was Jeff Prosise's excellent book, *Programming Windows 95 with MFC* (Microsoft Press, 1996). As with everything, though, there is a cost. Writing a Windows program with MFC increases the size of the program dramatically and ties future program development to Microsoft's continuing support of MFC.

ClipAid works by hooking into the clipboard via the Clipboard Viewer interface. This interface, as old as Windows itself, lets any window become a clipboard viewer—that is, a window that is notified whenever the clipboard data changes. Notification is sent via a message to each window in the clipboard-viewer chain. When ClipAid is notified that the clipboard has changed, it checks to see if a URL data type is already in the clipboard. If not, and if the clipboard contains text data of less than 256 characters in length, ClipAid opens the clipboard and copies the text to a buffer.

The string from the clipboard is analyzed using a few simple rules to see if it describes a URL. First, any spaces or control characters are stripped from the beginning of the string, and the string is truncated at the first space or control character after the first letter or number. The program then checks to see if the string contains any of the standard URL prefixes, such as `http://` or `ftp://`. If so, the prefix is used to identify the type of URL. If a URL prefix is not found, the program searches for the characters `www.` at the start of the string. If they are found, the string is identified as a Web address. If the previous tests have failed, the program checks to see if the character `@` is contained in the string. If it is found, and if it is not the first or last character in the string, the string is identified as an e-mail address.

If one of these tests succeeds, the clipboard string is identified as a URL. ClipAid then checks whether the URL prefix is part of the string and prepends it if it is not. The cleaned-up URL is then copied to the history list, and if ClipAid is in the proper mode, the URL data type is inserted into the clipboard.

CLIPBOARD COPYING

The copying of URL data types into the clipboard is ClipAid's most interesting aspect. That is what enables Explorer to paste a shortcut version of the URL onto the desktop or a folder. I learned how this works by observing the interactions between Microsoft Internet Explorer and Windows Explorer, using a small clipboard viewer program I wrote for the purpose. It turns out that the process involves more than just inserting a data type into the clipboard.

When you issue a Copy Shortcut command within Internet Explorer, the program inserts numerous data types into the clipboard. Some describe the shortcut; others

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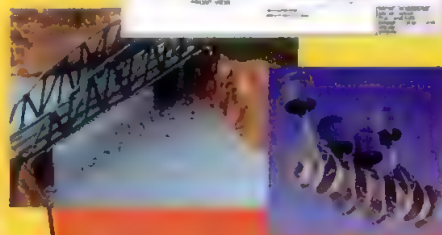
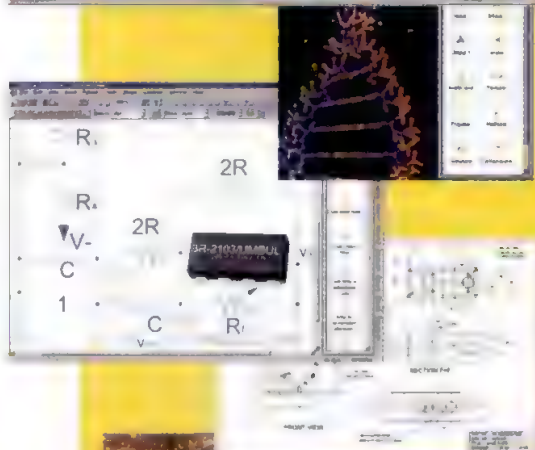
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contain seemingly irrelevant information. The table on the right shows a list of the different data types that Internet Explorer copies into the clipboard after a Copy Shortcut command.

Notice that Internet Explorer places a UniformResourceLocator (URL) data type in the clipboard. After a little investigation, I discovered that this format is little more than the address of the link (in ASCII text)—for example, <http://www.netscape.com>—with the URL data type label. The FileGroupDescriptor data type is a series of structures containing information about a file copied to the clipboard. While the URL itself is not a file, pasting it to the desktop will create a shortcut file with the extension .url. Explorer needs the information from the file group descriptor in order to create this file. The FileGroupDescriptor data type is used by Explorer when a list of files is copied into the clipboard. In this case, the only “file” is the potential shortcut file that will be created from the clipboard’s contents. The FileContents data type contains the ASCII text within an Internet shortcut (.url) file. Here is an example of the text from a URL file on my desktop:

[InternetShortcut]
URL=<http://www.netscape.com>

The most interesting (and problematic) data type is the DataObject—actually an OLE interface to the other data in the clipboard. If a DataObject interface is in the clipboard, programs that support OLE can use this interface to query the data in the clipboard, instead of using the standard GetClipboardData API function.

ENTER MFC

Unfortunately for our desire for simplicity in ClipAid, to paste a URL shortcut onto the desktop or into a folder, Explorer requires the

CLIPBOARD DATA TYPES

Type	Windows-assigned temporary identifier
DataObject	0xD346
UniformResourceLocator	0xCCA6
Text	0x0001
FileGroupDescriptor	0xCCAE
FileContents	0xCD9A
OLE Private Data	0xD358
Locale	0x0010
OEM Text	0x0007

DataObject data type to be inserted in the clipboard. Since inserting a DataObject data type requires the support of numerous complex OLE interfaces, I turned to MFC for help. MFC contains a COleDataSource object that is easy to create and insert into the clipboard.

The COleDataSource object is fairly simple to use. Once the object is created, the relevant data types are inserted into the COleDataSource object using the CacheGlobalData member function. The format of the data inserted into the object is the same as if the data had been inserted into the clipboard directly using the standard clipboard API functions. Once all the data types have been inserted into the object, ClipAid inserts a DataObject type into the clipboard using the SetClipboardData member function. Simple.

To enable Explorer to copy an Internet shortcut onto the desktop, ClipAid creates the proper data types and inserts them into the clipboard using the COleDataSource object. The data types inserted by ClipAid include URL, FileGroupDescriptor, FileContents, and DataObject, the last of which is inserted implicitly by COleDataSource. With the exception of FileGroupDescriptor, the data types are simple ASCII data strings that represent the name of the shortcut and the contents of the potential shortcut file. Of

course, the original text data type is retained in the clipboard as well.

In the modes in which ClipAid attempts to insert the URL into the clipboard while retaining the original data types, additional effort is involved. When the COleDataSource object is copied into the clipboard, it clears the clipboard first. To retain as much information as possible, ClipAid first attempts to copy all the data out of the clipboard, keeping each data type separate. This is done by reading each data type from the clipboard into separate global memory blocks. Then, the COleDataSource object is reinitialized with all the data that was in the clipboard plus the new data types required for the URL recognition.

Other aspects of ClipAid are fairly straightforward for an MFC application. The main window is composed of a PropertySheet that is created using a CPropertySheet object along with three CPropertyPage objects. The routines that implement each page are very similar to dialog procedures. Each has an InitDialog function that contains the initialization code for each page.

The icon on the Taskbar is created using the Shell_NotifyIcon API function, which allows programs to create and destroy icons on the Taskbar, as well as providing a method for notifying a window when a mouse action occurs over the icon on the bar. The ClipAid window is created only once, when ClipAid is started, and is made visible only when the user chooses to see it. When the user dismisses the window, it is hidden, ready to appear again whenever he or she needs it.

ClipAid’s ability to maintain a history list of copied URLs, coupled with its ease of use, make ClipAid a handy assistant for those who use the Internet. □

Douglas Boling is a contributing editor of PC Magazine.

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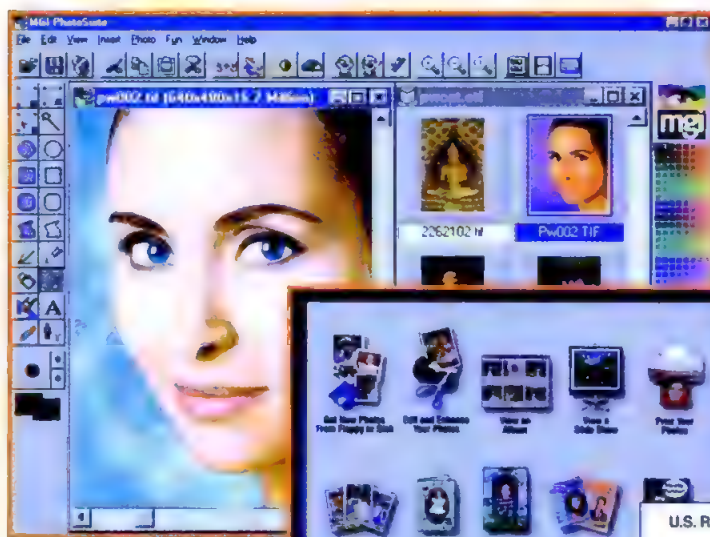
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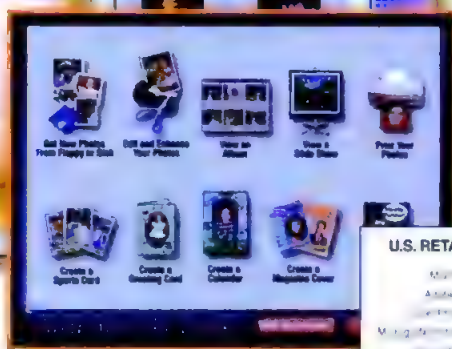
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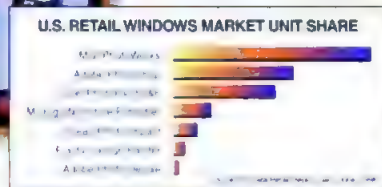
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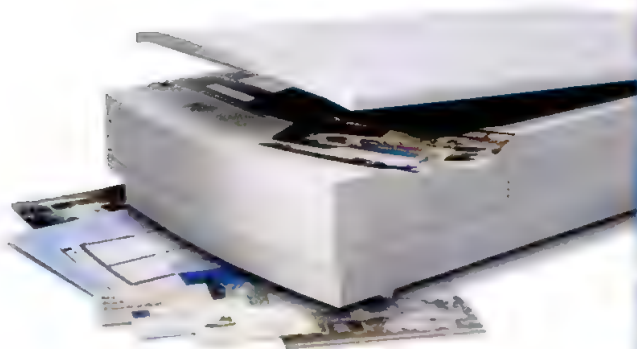
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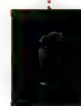
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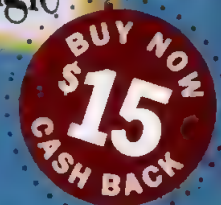
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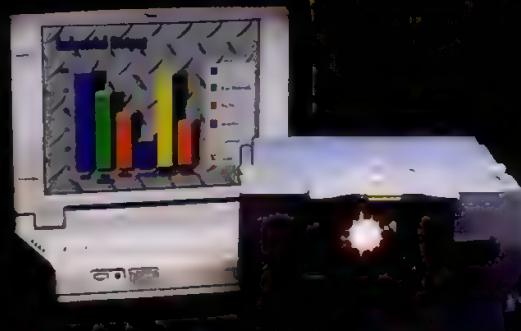
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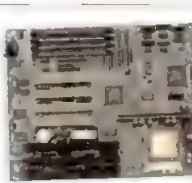


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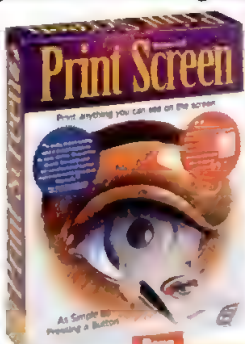
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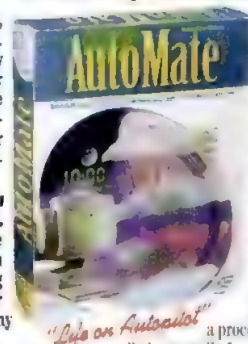
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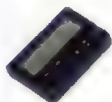
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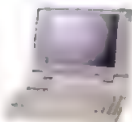
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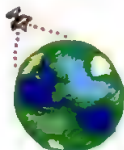


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User-to-User

By Neil J. Rubenking

A Default Font for Windows Write

The item "Setting a Default Font for Write in Windows 3.1x" in the Solutions column of October 22, 1996, stated: "I can't explain the use of Impact as your default font. . . ."

Here is the explanation: In the [fonts] group of the WIN.INI file, the first *.FOT file referenced designates the default font for Write. Therefore, you can easily make Arial the default font by moving the line

```
Arial (True Type)=ARIAL.FOT
```

to the very top of the [fonts] group—precisely where it is when Windows is installed.

The solution presented in your response lets the user control the font when Write is started from the icon. But it doesn't fix the problem when you start Write from the File | Run menu, for example, or by double-clicking on a .WRI file in File Manager. My solution works regardless of the way in which Write is executed.

PRZEMYSŁAW BOGACKI
Norfolk, Virginia

PC MAGAZINE: The default font used by Windows 3.1x Write is indeed controlled by the order of the entries in the [Fonts] section of WIN.INI, but it's not quite as simple as "the first .FOT file." Rather, Write will choose as its default font the first .FOT file in the [fonts] list that the program finds acceptable, according to some undetermined criteria. On my system, those fonts include Arial, Arial Narrow, Arial Rounded MT Bold, Britannic Bold, Century Gothic, and Impact.

To determine which fonts Write would accept, I sorted the contents of the [Fonts] section in reverse order, started Windows, and checked which font Write chose. After noting the font's name, I exited from Windows, moved the font that Write chose to the end of the list, and checked again. The results were clear. Whichever of the "acceptable" fonts is first in the list will be used as the default font for Write. If you find yourself using Write in Windows 3.1x quite a bit, you may want to repeat this experiment on your own system, as your collection of fonts may well be different.

Moving Arial to the beginning of the

[fonts] list in WIN.INI solves the problem of having Write come up with a hard-to-read font like Impact as its default. But if you choose to set Write's default font to some other specific font, your success will depend on whether Write accepts that font. If Write doesn't use the font after you move it to the beginning of the list, you will still have to resort to the technique described in the earlier response—that is, create a read-only .WRI file with the desired font and other attributes and edit Write's Program Manager icon so it always opens that particular file.

Mystery Features in Windows 95

In a recent column ("OS Decay: Here to Stay?", August 1996), John C. Dvorak mentioned his surprise at the smooth scrolling of the Windows 95 Taskbar on one system but not on others. Here's where it comes from: The Taskbar is actually a window and is affected by the Microsoft Plus! screen-enhancement functions, just as any other application window is. Specifically, there is a check box for "Show window contents while dragging" on the Plus! tab of Display Properties. When this box is checked, it causes the Taskbar to gradually slide up and down instead of just popping in and out of existence when auto-hide is on. It's a nice effect on a reasonably fast system but excruciatingly slow on a 486 with only 8MB of RAM. (Of course, that can be said of Windows 95 in general!)

GEORGE BYRD
via the Internet

PC MAGAZINE: As Dvorak noted, it's frustrating to see a new feature appear seemingly spontaneously. Without an explanation of the feature's source, you can't enable it on other systems. Quite a few readers wrote to point out that the "ultracool" Taskbar scrolling behavior comes from the Plus! pack's display enhancements.

Alert readers may have noticed another interesting change in system behavior recently. When the mouse moves over a column heading in Explorer's detail view, the heading text may change to the Selected color (the system color that's normally used as the background for the selected item in menus, list boxes, list views, and so on). The same thing happens in

HIGHLIGHTS



HARDWARE New software isn't your only option if you want to dual boot. Here's a simple hardware solution to consider. *Page 288.*



ONLINE Learn how to set up HyperTerminal so you can send commands to your modem manually, in our new Online section of PC Solutions. *Page 292.*



DATABASES Removing the most recently used files list should get easier in Access for Windows 97, but in the meantime, this solution will do the job. *Page 301.*

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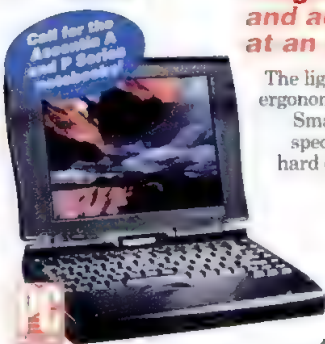
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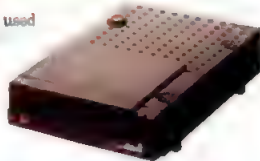
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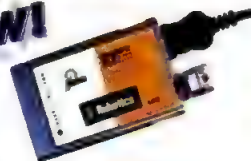
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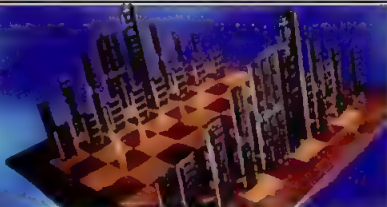
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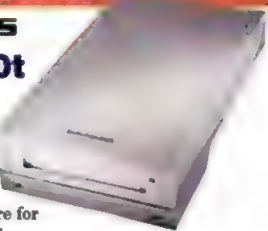
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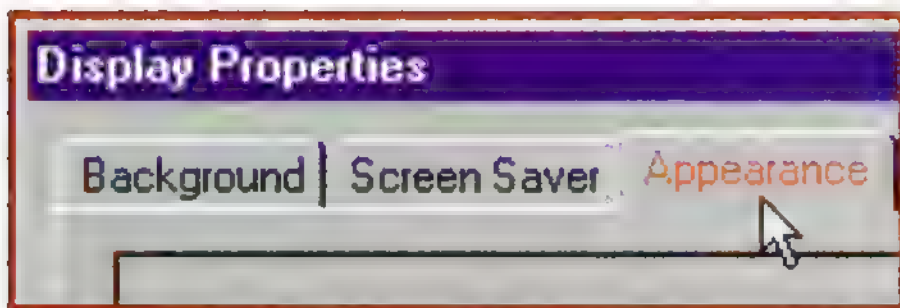


FIGURE 1: After Microsoft Internet Explorer 3.0 has been installed, some Windows 95 common controls will display mouse-aware highlighting.

tabbed dialogs: When the mouse moves over a tab, its title text changes to the Selected color. This behavior is more obvious if the Selected color is set to bright red rather than to the Win 95 default of dark blue. Figure 1, an enlarged view of the Display Properties dialog, shows this mouse-aware highlighting.

The likely source of this behavior is Microsoft Internet Explorer 3.0. IE 3.0's install program updates the Comctl32.dll library, which supplies all of the Windows 95 common controls. The new versions of the list-view control and tab-sheet control perform this mouse-aware highlighting automatically. Even if you uninstall IE 3.0, the updated DLL remains behind.

More on Spanning Disks with PKZIP

Thanks for the helpful advice, in your issue of September 24, 1996, on using PKZIP to span floppy disks when archiving large files. There are a couple of caveats to keep in mind. PKZIP alters the volume label of each floppy disk when you use the `-b` option, labeling them `PKBACK #xxx`, where `xxx` equals 001, 002, and so forth, to identify which disk in a multiple-disk set you have inserted. That means if you put an unspanned .ZIP file on a disk that previously contained a spanned file, PKZIP will still ask for the last backup disk in the set when you unzip, because of the previously written label. This can be confusing.

Perhaps more serious is the risk of data loss when spanning multiple floppy disks with large .ZIP files. PKZIP uses all the available space on a floppy disk before asking for another disk. Inevitably, if the same disk is written to enough times, you'll end up with some bad sectors, and because there are no free clusters, neither SCANDISK nor the Norton Utilities Disk Doctor can fix the disk by replacing the bad clusters with good ones. If that occurs, your .ZIP file is unrecoverable. The only solution is to reserve a little space on each floppy by copying a small file onto the disk before using PKZIP `-b`. (Note that the `-bw` or `-bu` options will of course erase that file.) Then, if bad sectors occur, delete the reserve file and run the disk-recovery utility.

JOSEPH MADDISON
Minneapolis, Minnesota

PC MAGAZINE: One common reason to split a large file across multiple floppy disks, whether using PKZIP or PC Magazine's SPLICE utility, involves the immediate reassembly of the large file on another computer. If you frequently transfer large and small files using this kind of "sneaker net," chances are good you'll run into the volume label

problem noted here. When you maintain one disk or set of disks that you use primarily for transferring files between systems, you should regularly clear the disk's contents and volume label with a quick format. The command

```
FORMAT A: /Q/U/V:transfer
```

will quickly reformat the disk and change its volume label to "transfer."

If you're splitting files for immediate file transfer, a bad sector is only a minor annoyance: You can reformat the offending disk and split the large file again. But if your purpose in splitting up the file is to store an archival copy, you should be prepared to deal with bad sectors. Before using floppy disks for this kind of storage, take the time to reformat them completely using the command `FORMAT A: /U`. Then create one or two small files on the disk. If a bad sector turns up later, you can delete these placeholder files and try to recover using SCANDISK or another disk-recovery utility.

As noted above, the `-bw` and `-bu` switches will wipe out the placeholder files. The `-bw` switch wipes all files from each floppy disk in the set before writing to it, and the `-bu` switch formats each disk. These switches are quite handy when you're splitting up files for sneaker-net transfer, but they'll subvert your efforts to create placeholder files on archival disks. Other switches to avoid when splitting a file for archival purposes are `-bf` (format), `-bl` (format low density), and `-blu` (format low density unconditionally).

Reclaim Disk Space Hogged by Help

If you're interested in reclaiming every iota of disk space, you won't want to overlook the full-text search (.FTS) files the Windows 95 help program creates when you click on the Find tab of the Help dialog. These files, generated whenever you perform a full-text search of the help file, can get quite large (over 2MB) for large help files. So it's a good idea to get rid of all the .FTS files on your disk periodically. That won't cause any problems, since the Windows help program will regenerate the file for you the next time you need it.

RAFAEL MAYER
via the Internet

PC MAGAZINE: Windows 95 and Windows NT both rely on WinHelp 4 to manage help systems. When you open a help system written for WinHelp 4, you see the Help Finder dialog with its Contents, Index, and Find tabs. The Contents tab is an outline view of the help file's topics, and the Index tab lets you search for topics by specifying a keyword. But when you click on the Find tab, you're asking WinHelp 4 to search for a particular word anywhere in the help system's text, whether it's defined as a keyword or not.

The first time you request a full-text search of a given help file, WinHelp 4 creates a full-text search index and stores it as a file with the same name as the help file and the extension .FTS. The .FTS file will remain on your disk, taking up space, even if you never request a full-text search on that file again. Try using the Find Files or Folders command from the Start menu to search for all the .FTS files on your system. You may be

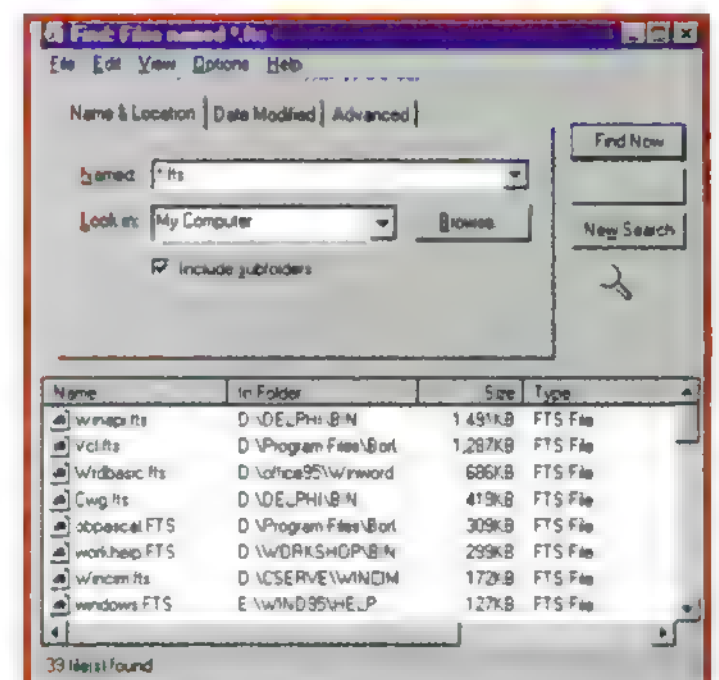


FIGURE 2: You may be surprised at the number of .FTS files on your hard disk—and by their sizes.

surprised at how many there are—and how big they are (Figure 2). You can select and delete them all for a significant savings in disk space. On the other hand, creating an .FTS file can take an appreciable amount of time when the help file is very large. If you perform full-text searches on a particular help file frequently, you may want to grant it a reprieve.

You'll also find files with the extension .GID scattered around your hard disk, each with the same filename as a .HLP file in the same directory. The .GID file speeds WinHelp's access to help topics and stores status information, such as the position of the help window. Normally, .GID files don't grow as large as .FTS files, and the .GID file will be re-created each time you open the corresponding help file, not just when you request a full-text search. But you may want to purge .GID files that correspond to help files you rarely use.

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HARDWARE

Dual Boot the Hardware Way



I recently moved to Windows 95, but for a number of reasons I need to keep the Windows 3.11 environment available on my PC. I tried various software options for multibooting, but I wasn't completely satisfied with any of them.

Instead, I devised a system that lets me boot up directly into either operating system. My system contains an IDE drive with Windows 3.11 and a SCSI drive with Windows 95. When the IDE interface on the motherboard is enabled, the IDE drive is the boot drive and Windows 3.11 loads. If I go into the CMOS and disable the IDE interface, then the SCSI drive boots into Windows 95.

I admit that the step of changing the CMOS settings is a bit inelegant, but it works well for me and I have yet to encounter any difficulties with this system.

JOHN DOUGLAS YOUNG
Baton Rouge, Louisiana

PC MAGAZINE: Sometimes a hardware solution may be appealing, but this one does have a few disadvantages. If you want to be able to access your data in either environment, you have to keep all your files on your SCSI drive. Also, your Windows 95 configuration is potentially at risk, because the files are available when you're running under Windows 3.11.

Another approach would be to keep your operating system on a removable media drive, such as an optical drive or removable hard disk. Some of these drives are bootable, so you could configure your system to boot directly from one of them. For a drive that can't boot directly, you could create a boot disk that would start the process and then transfer control to the removable media.

For most people, swapping floppy disks and removable cartridges is probably less troublesome than changing the CMOS settings. And with this approach, you can use more than two operating systems; you can set up as many cartridges as you need. All of your data files can remain on your fixed disk drive and be available under each operating system, and you won't have to worry about one configuration damaging another's system files.—*Alfred Poor*

Major Overhaul

We're thinking of upgrading our 386DX/25 computer so we can use Windows 95 and access the Internet. I know we could upgrade the CPU, but replacing the entire motherboard with one that has a DX4/100 processor seems to make more sense. We also need a new hard disk, CD-ROM drive, and a modem. We have 12MB of memory; will that be sufficient for Windows 95? Any suggestions you have would be appreciated.

ANDY VOIGT
via fax

PC MAGAZINE: You've got the right idea, but you may want to consider a different approach. Your shopping list appears to include a motherboard, hard disk, CD-ROM drive, and modem. You don't mention a graphics card, but your new motherboard is certain to have local bus expansion slots (either VL-Bus or PCI), and you'll be wasting a large part of your system's potential performance if you stick with your old ISA graphics adapter. Although you already have 12MB of memory, you'll really need 16MB for most Windows 95 configurations, so you'll want to add at least 4MB. You can't assume, however, that the memory you have now is fast enough

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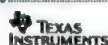
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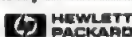
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for your new system. (It may be, but be sure to check the specifications before you set up your system.)

When you're finished, all you'll be keeping from the old system is the case, the floppy disk drive, the keyboard, and the monitor. Aside from the monitor, it could easily cost less than \$100 to replace the rest of your system with new components.

When your upgrade plans are so extensive, it pays to consider purchasing an entirely new system. (If your budget is tight, you may want to skip the new monitor and continue to use your old one). By purchasing a new system, you get a single warranty from a single vendor, and the whole unit will come configured and tested. In contrast, doing it yourself will leave you with four or more manufacturers to rely on for warranty service (if you can ever determine which component isn't working correctly in the first place), and you'll be responsible for configuring it and making it work.

It may well be cheaper in the long run to buy an entirely new system. You'll also end up with a second working computer, which you can donate to an organization that needs it, such as a church or school, or just put on the shelf, in case you need another computer for some simple task. —Alfred Poor

OPERATING ENVIRONMENTS

Automatic CDs



How can I add an icon and hotkey to my desktop that I can use to open and close the CD-ROM drawer automatically, no matter which application is running? My Gateway P5-90 computer is housed in a tower case that sits on the floor. The CD-ROM drawer button is located below the drawer, making it very difficult to reach, since the drawer itself is in the way. I know the drawer can be opened by software, as I have two applications that contain working Eject buttons.

JOHN MOORE
Bel Air, Maryland

PC MAGAZINE: Various utilities include the ability to eject a CD-ROM, but few of them will close the CD drawer. Also, they don't lend themselves to hotkey control over a single feature like opening or closing the drawer. I wrote the tiny Delphi program shown in Figure 1 to handle this reader's need. You can download the executable file, which is under 3K in size, from PC Magazine Online. (For details, see the sidebar "Guide to Our Utilities" in this issue's Utilities column.)

To install the program and create a hotkey for it, first locate it in Explorer and drag it onto the desktop. Right-click on the resulting shortcut, choose Properties from the menu, and click on the Shortcut tab. Click on the Shortcut key box, then press the shortcut key

```
program cdinout;
```

```
uses mmSystem;
```

```
VAR
```

```
  MCIO : TMCIO_Open_Parms;
```

```
  MCIS : TMCIO_Status_Parms;
```

```
begin
```

```
  MCIO.lpszDeviceType := PChar(MCIO_DEVTYPE_CD_AUDIO);
```

```
  IF mciSendCommand(0, MCI_OPEN, MCI_OPEN_TYPE OR MCI_OPEN_TYPE_ID OR  
    MCI_OPEN_SHAREABLE, LongInt(@MCIO)) = 0 THEN
```

```
  BEGIN
```

```
    MCIS.dwItem := MCI_STATUS_READY;
```

```
    mciSendCommand(MCIO.wDeviceID, MCI_STATUS, MCI_STATUS_ITEM  
      OR MCI_WAIT, LongInt(@MCIS));
```

```
    IF MCIS.dwReturn <> 0 THEN
```

```
      mciSendCommand(MCIO.wDeviceID, MCI_SET, MCI_SET_DOOR_OPEN, 0)
```

```
    ELSE
```

```
      mciSendCommand(MCIO.wDeviceID, MCI_SET, MCI_SET_DOOR_CLOSED, 0);
```

```
      mciSendCommand(MCIO.wDeviceID, MCI_CLOSE, MCI_WAIT, 0);
```

```
    END;
```

```
end.
```

FIGURE 1: This tiny listing can be compiled with Delphi 1.0 or Delphi 2.0 to produce a program that will open and close the CD-ROM drawer.

you want to use. Now click on the Change Icon button. Explorer will inform you that the program itself contains no icons and will offer a list of icons for you to choose from. The twelfth icon is a likely choice; it shows a CD and CD-ROM drive. Click OK to accept the icon, and OK again to accept the changes to the shortcut.

Now you can press the hotkey at any point to open the CD drawer if it's closed, or close it if it's open. Double-clicking on the icon on the desktop will have the same effect.

—Neil J. Rubenking

ONLINE

HyperTerminal in Manual Mode



I don't see a way to use HyperTerminal, the communications applet bundled with Win 95, without entering and saving an outgoing phone number. Sometimes I need to send commands to my modem without dialing out—for example, to issue setting commands or to retrieve information about modem settings. Is there a way to set up HyperTerminal for manual use, or do I need to install a general communications package for this?

SUE DRUCKER
Putney, Vermont

PC MAGAZINE: You don't need to install a general communications package. Instead, here's how you can set up HyperTerminal so you can manually issue commands:

When you first launch HyperTerminal (Hypertrm.exe), a Connection Description dialog box will ask you to Enter a name and choose an icon for the connection. Type a name like "General Communications" and click OK. Next, a Phone Number dialog box will prompt you for dialing information. By default, the Connect using: combo box is set to your modem. Click the down arrow to bring up a list of choices. Along with any modems you have registered on your system, you'll see four additional choices: Direct to Com 1, Direct to Com 2, Direct to Com 3, and Direct to Com 4. Select the Direct to option for the communications port where your modem is installed. (This is not necessarily Com 1.) When you make this selection, the other fields in the edit box, including the phone number, will be grayed out. Click OK to accept your selection, and HyperTerminal will display a Properties sheet for the Com port you selected. Use the same settings here as you used when setting up your modem in Control Panel's Modems applet. Click OK and HyperTerminal will be configured as a general communications program.

The last step is to save your settings. Choose Save from the File menu to keep "General Communications" (or whatever you typed as a description) as the name of your setup. To select a different name, choose Save As and enter the name in the edit box. That's all there is to it. The next time you want to send commands to your modem manually, simply double-click the icon for your General Communications setup.

—Sheryl Canter, contributing editor



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WORD PROCESSING

More About Heading Numbering in Word



In your issue of January 9, 1996, you discuss a limitation in Microsoft Word's heading-numbering feature that makes it difficult to automatically add numbers to chapters and letters to appendices in the same file. You recommend keeping the chapters and appendices in separate files and printing them separately but advise merging them for editing by linking them to a third file with Include-Text fields. There's an alternative solution that may be easier.

Word 6.0 and 7.0 let you define automatic numbering for up to nine heading levels. If you

Word's built-in definitions for the heading styles assign different font and paragraph formats to each heading level.

need, say, five levels in the body of the document, you can use the last four in the appendices. Redefine the sixth heading level—the first for the appendices—so that it doesn't use anything from previous levels, uses letters for its numbering, and otherwise has the same settings as Heading 1. Then similarly redefine the seventh heading level to match the second, the eighth level to match the third, and the ninth level to match the fourth.

With the heading levels appropriately redefined, you can use Heading 6 for the first heading level in the appendices, Heading 7 for the second, and so on, without worrying about hard-to-follow links or extra files.

V. JACOBS
via ZD Net

PC MAGAZINE: This workaround may be preferable in some cases, because of the obvious advantage of letting you keep everything in one file, but it also has disadvantages.

The single biggest disadvantage with this approach is that you won't be able to include the numbers from previous levels for the appendices. You can't, for example, include levels in the appendices that read A, A.1, and A.1.1. If you define a level 7 to include previ-

ous numbers, it will include numbers from all the higher levels, not just level 6. If this isn't a problem, however, the rest of the disadvantages are minor.

To format the heading levels, you first have to choose Format | Heading Numbering, select the predefined format that's closest to the format you want, and choose Modify to open the Modify Heading Numbering dialog box. The dialog box is reasonably self-explanatory, so we won't go into the details here except to say that it's limited to letting you define the numbering scheme. Although it's not hard to match the numbering format of, say, Heading 6 to Heading 1, this is only the first step.

Word's built-in definitions for the heading styles assign different font and paragraph formats to each heading level as well. If you browse through the styles, you'll see differences in fonts, font sizes, paragraph indents, and more. So for each heading level that you use in the appendices, you also have to redefine the font and paragraph formats for the heading style so that it matches the equivalent heading levels for the body of the document. This isn't difficult, but it takes time.

For those who aren't familiar with how to redefine styles, the easiest way is to choose Format | Style, pick All Styles from the drop-down list, highlight the style you want to change, and choose Modify to open the Modify Style dialog box.

Next, choose the Format | Font to open the Font dialog box and make the changes to the style's font definition. Choose OK to close the Font dialog box and Format | Paragraph to open the Paragraph dialog box. Here again, make the appropriate changes, choose OK to close the dialog box, and click OK again to close the Modify Style dialog box. Then highlight the next heading style you need to redefine and repeat the process.

If you plan to insert a table of contents, you'll also need to define the table of contents options to treat both Heading 1 and Heading 6 as level 1 for the table of contents, treat Heading 2 and Heading 7 as level 2 for the table of contents, and so on. To define the table of contents options when you insert the table, choose Insert | Index And Tables. Then go to the Table Of Contents tabbed card and choose Options. In the scrollable list of Available Styles, make sure there's a 1 under TOC levels for both Heading 1 and Heading 6, a 2 for both Heading 2 and Heading 7, and a 3 for both Heading 3 and Heading 8. Choose OK to close the Table Of Contents Options dialog box and click OK again to insert the table.

One drawback you're stuck with if you take

this approach to heading numbering is that if you use outline view, all the appendices will show as levels within the last chapter of the document. But this is only a consideration if you normally use the built-in collapsible outliner. For those who don't use the outline view, this is not an issue.—M. David Stone

SPREADSHEETS

Conditional Factors Through Lookup Tables



To produce our company price list, I export data from the Inventory Control module of Computer Associates' Accpac Plus to Report Master, an add-on utility, which then runs various formulas on our costs to arrive at selling prices. Report Master then exports to Microsoft Excel, which does all the necessary formatting and prints the final price list. All this takes too much time, but I haven't been able to export directly from Accpac Plus into Excel, because I haven't found a way to create similar formulas in Excel. The formula I am using accomplishes tasks such as the following: If cost is less than \$50, multiply by 2.0. If cost is between \$50 and \$100, multiply by 1.8. And if cost is between \$100 and \$150, multiply by 1.5—and so on.

Can I do this kind of calculation in Excel? Should I be using Microsoft Access instead?

MANNY O. MANAPAT
Foster City, California

PC MAGAZINE: You can do this easily with Excel's VLOOKUP function. Figure 2 illustrates the method. A simple two-column table appears in A1:B5. This table, which I've

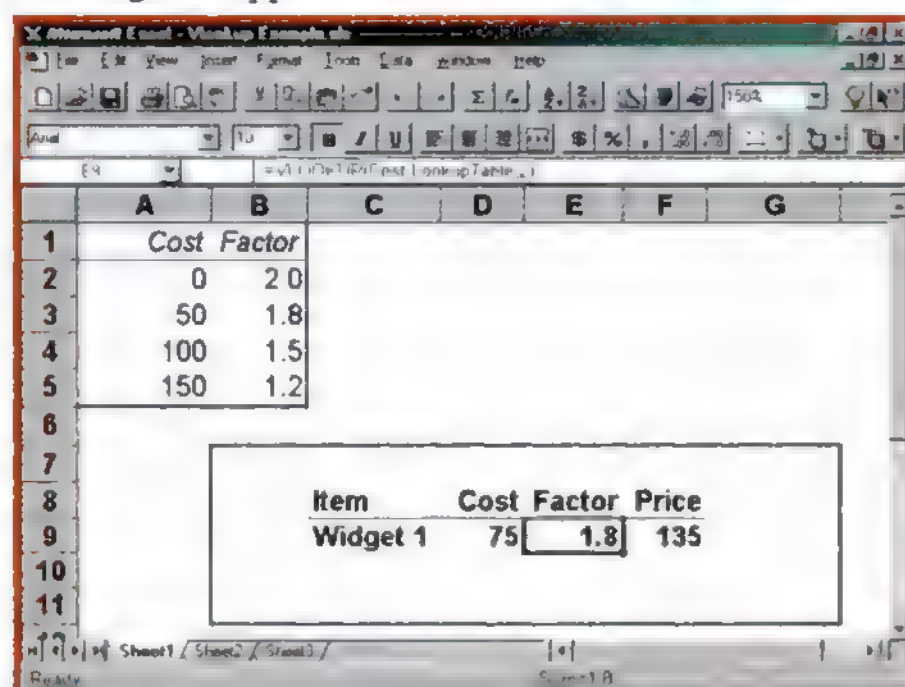


FIGURE 2: Microsoft Excel's VLOOKUP function returns a cell from a table based on the input value.

named LookupTable, supplies the information that VLOOKUP will use to calculate a pricing factor. The formula and its resulting factor appear in cell E9, as follows:

=VLOOKUP(Cost, LookupTable, 2)

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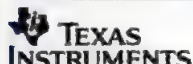


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The formula has three arguments. The first is your "lookup" value. In our formula, that's the cost of the item in question, and its value is stored in D9. I have assigned the name Cost to E8 to make the formula more readable, but a plain reference to D9 would work just as well. The second argument is the table itself. The third argument is the column of the table from which we want VLOOKUP to return a value. In our case, that's column 2, the one with the factor values.

The formula tells Excel to look at the value in E8, scan through the leftmost column of the lookup table until it finds a value greater than E8, move back one row in the table, go to column 2 of the table, and return whatever value it finds there. In our example, D9 holds 75, so the function scans through column A until it reaches A4. It then retreats to A3, moves over to B3, and returns the value there—which is 1.8. Once you've got this factor, it's a simple matter of placing a formula in F9 that multiplies Cost with Factor.

Note that if your lookup value is equal to or greater than the last item in the leftmost column of the lookup table, the function returns a value from the bottom row of the table.

—Craig Stinson

DATABASES

Removing the Most Recently Used Files List in Access



I've often been asked how to remove the most recently used files list from the File menu in Microsoft Access. While it's difficult to do this programmatically in either Access 2.0 or Access for Windows 95, it can be done manually.

In both versions of Access, the information from the MRU list is stored in the AccessPreferences table in your workgroup database, normally SYSTEM.MDA. It's stored on a per-user basis; Access looks at the table only when you start up and loads the (up to four) items into memory. Then, when you quit, it saves the information back to the table. Even if you delete the rows from the table, Access puts them back in when you quit. That's the problem: No matter what you do with AccessPreferences during a session, when you quit, Access refills the table with what it thinks is the correct list.

The solution is to log on as a different user, delete the rows from the table, quit, and then the next time you start Access log on as yourself, the list will be empty again. Here's the procedure:

- Create a new user account. Then quit Access and restart it, logging on as that new user.
- Use the File | Attach Table menu item to attach the AccessPreferences table from SYSTEM.MDA (or whatever your workgroup file is).

- Find the rows with the Prf column values of 13, 14, 15, and 16 for your own normal account. Delete them. (The preferences are listed by number for each user account.) You could, of course, automate this step with a

Prf	Name	Username
0		8 Admin
2		17 Admin
2		18 Admin
2		19 Admin
0		20 Admin
0		21 Admin
0:150:140:580:370		68 Admin
0:300:50:400:200		69 Admin
255		75 Admin
0:178:90:503:340		78 Admin
0:85:61:410:311		80 Admin
F\ACCESS\MRU.1		13 Salr
2		17 Salr

FIGURE 3: Microsoft Access 2.0 and Microsoft Access for Windows 95 both store your most recently used files list in the AccessPreferences table in your workgroup database.

Delete query such as this (assuming your log-on name is JoeC):

```
DELETE * FROM AccessPreferences
WHERE ((Prf Between 13 And 16) AND
(Username="JoeC"));
```

Now quit, then restart Access with your normal log-on. The MRU listing will be empty. This may not be the ideal solution, but it works.

KEN GETZ

Los Angeles, California

PC MAGAZINE: There should be an easier way to do this. SYSTEM.MDA (Access's workgroup database) is where the User and Group security accounts are stored. It's also where Access keeps your user preferences. Normally you should leave this file alone, but if you want to purge Access's File menu of those MRU database entries, your options are few.

Mr. Getz's technique applies to Access 2.0 and Access 95. If you're using Access 95, you can select the Tools menu and choose Security, User and Group Accounts to create a new user name. After that you can exit Access and then start it up again with the /User command line option, specifying your new user name. For example, entering \MSOFFICE\ACCESS\MSACCESS /User SalR from the Run menu starts Access with the user name SalR.

To attach the AccessPreferences table, you need to open a database or create a new one in which to attach the table. Then choose File | Get External Data | Link Tables. Once the table is attached, delete the entries whose Prf value is between 13 and 16 and whose user name is your normal log-on name.

If you're using Access 2.0, you can open a database, select the Security menu and then

choose Users to create a new user name. Then you can exit from Access and start it up again using the /User command line option with the new log-on name. To attach the AccessPreferences table, open an existing database or create a new database (call it Mru) to hold the attached table. Then select the File menu, choose Attach table, enter System.mda, and select AccessPreferences. Your screen will look something like Figure 3. You can then delete the most recently used file entries.

Microsoft suggests an alternative technique for users of both versions, but only if your database is unsecured. If you're using Access 95, you can use Explorer to run the Wrkgadm file in your Access folder. Then step through the prompts to create a new System.mdw file. Creating a new System.mdw clears the most recently used files list. If you're using Access 2.0 under Windows 95 you can follow the same procedure, but you'll be creating a System.mda instead of a System.mdw. And if you're using Access 2.0 under Windows 3.1, you can double-click the MS Access Workgroup Administrator to create a new System.mda.

None of these solutions is ideal—an option should be available in Access and every Office application to clear and disable the MRU list. The situation improves a little in Microsoft Access for Windows 97 (in beta as of this writing). Access 97 stores the most recently used files list in the user profile section of the Registry. When Access 97 starts, the most recently used file list is read from the Registry and stored in SYSTEM.MDA. When Access 97 exits, it writes the most recently used file list back to the Registry. That means you can effectively remove the MRU list by deleting those entries from the Registry from outside of Microsoft Access, using RegEdit, for example.—Sal Ricciardi

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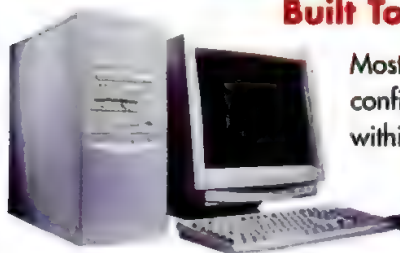
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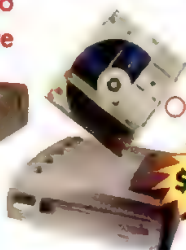


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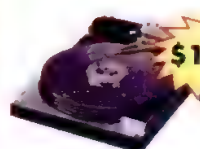
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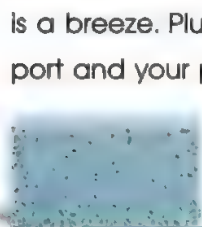
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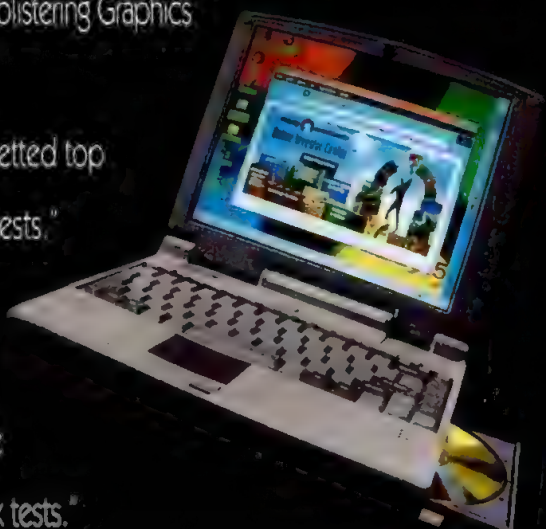
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If internal - go on to step 3. If external, add an external case (EXTCDCASE) \$100, and the proper cable. We will even install the drive in the case for you.

3 - CHOOSE YOUR SOFTWARE

Corel CD Creator Pro for PC	\$40
-Supports Windows 3.1, 95, NT (CORELCPRO)	
Incat Easy-CD	\$60
-Supports Windows 3.1, 95, NT (INCATPC)	
Astarte Toast CD-ROM Pro	\$85
-Supports Macintosh (TOAST)	
Elektrosen Gear Multimedia for PC	\$69
-Supports OS/2, Windows 3.1, 95, NT	
-Also supports Macintosh (GEAR)	
Creative Digital Research CDR HYCD for PC	\$359
-Supports Windows 3.1, 95, NT	
-Creates hybrid CDs for PC/Mac/Unix (CDRHYWIN)	
Creative Digital Research CDR HYCD for Unix	\$1299
-For Unix workstations	
-Creates hybrid CDs for PC/Mac/Unix (CDRHYUNIX)	

4 - CHOOSE YOUR SCSI CONTROLLER

16Bit ISA PIO Adaptec (A1505CDKIT)	\$50
16Bit ISA Bus Master Advansys (ABP5140)	\$95
32Bit PCI Bus Master Advansys (ABP940)	\$125
32Bit PCI PIO Adaptec (A2920KIT)	\$159
32Bit PCI Bus Master Adaptec (A2930KIT)	\$189

5 - CHOOSE YOUR BLANK MEDIA

5 Pack (CDR74-5)	\$40
20 Pack (CDR74-20)	\$149
50 Pack (CDR74-50)	\$359
100 Pack (CDR74-100)	\$699
300 Pack CDR Labels, template software, and applicator	\$59

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IDE	\$79	\$39	\$49
SCSI	\$85	\$40	\$54
WIDE SCSI	\$129	\$64	\$75

Weather resistant case to store and transport cartridge \$55

• OPTICALS •

All Optical Drive prices below include 1 FREE cartridge.

230MB	Fujitsu IDE	\$339
230MB	Smart Storage Solutions SCSI	\$339
640MB	Smart Storage Solutions SCSI	\$539
640MB	Fujitsu (230MB backwards compatible)	\$555
650MB	Toray 4xCD and 640MB Optical comb.	\$299
2.6Gig	Smart Storage Solutions	\$1649
2.6Gig	Maxoptix	\$1699
2.6Gig	Hewlett Packard	\$2199
52Gig	Maxoptix (does not include free disks)	\$4549

• REMOVABLES •**\$40MB MCD** Call about manufacturer's \$50 rebate - good until 3/15/97

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SyQuest

230MB Flyer compatible with EZ135MB disks

External SCSI or parallel with 1 free disk \$299

Call about SyQuest \$55 mail-in rebate - until 2/28/97!

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External SCSI with 1 disk/Ext Parallel with 1 disk \$189/\$189

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Internal SCSI with 1 disk/Ext SCSI with 1 disk \$379/\$469

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PD Drive - 650MB optical & 4X CD ROM in one unit!

Kit with 3 free disks & controller Int. \$299 Ext. \$399

• CD RECORDERS •

These COMPLETE KITS include drive, controller, software, and 1 recordable CD disk. Smart Storage Solutions kit includes 5 FREE recordable CD disks!

Smart Storage Solutions	2X Write 4X Read	\$469
Hewlett Packard	2X Write 4X Read	\$559
Ricoh	2X Write 4X Read	\$475
Teac	4X Write 4X Read	\$829
Smart Storage Solutions	4X Write 4X Read	\$889
Yamaha	4X Write 4X Read	\$759

• CD ROM DRIVES •**SCSI**

Brand	Spin	Model	Speed	Int	Ext
NEC	4X	CDR222	200ms	\$99	\$189
Plextor	6X	PX63CS	145ms	\$269	\$359
Philips	8X	PC80S	195ms	\$205	\$305
NEC	8X	CDR1410	145ms	\$205	\$295
Plextor	8X	PX83CS	115ms	\$299	\$389
Pioneer	10X	DRU10XSCSI	140ms	\$225	\$315
Plextor	12X	PX12TS	105ms	\$319	\$409
Plextor	12X	PX12CS	105ms	\$349	\$439

ATAPI IDE

				Int	Int kit
NEC	8X	CDR1400	140ms	\$110	\$140
Mitsumi	8X	CRMCFX800	150ms	\$110	\$140
Acer	10X	AC910A	150ms	\$125	\$155
Pioneer	10X	DRA10X	140ms	\$135	\$165
Lite On	12X	LTN126A	155ms	\$129	\$159
Acer	12X	AC612A	125ms	\$149	\$179
Cyber	12X	CYBER12X	150ms	\$115	\$145
Mitsumi	12X	CRMCFX12X	150ms	\$175	\$205

IDE CD ROM CHANGER

NEC 4X CDR4X4 4 Disk 250ms \$99

SCSI CD ROM CHANGERS

Nakamichi 8X MJ48S	4 Disk	150ms	\$399
Pioneer 4.4X DRM-624X	6 Disk	190ms	\$379

• TAPE DRIVES •**QIC MINICARTRIDGE (SAVE \$10 with hard drive purchase)**

Includes DOS/Win backup software and 1 free tape.

800MB Seagate	TST800R	\$119
3.2Gig Seagate	TST3200RFT	\$215

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800MB Seagate	TST800RP	\$160
3.2Gig Seagate	TST3200RP	\$259

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4-8GB Seagate	TST8000(A)	\$369
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SCSI 4mm DAT

2GB Hewlett Packard	C1534AI	\$609
2-4GB Seagate	C4324RP	\$679
2-4GB Hewlett Packard	C1536AI	\$699
4-8GB Sony	SDT5000AI	\$809
4-8GB Seagate	C4326NP (DDS2)	\$859
4-8GB Hewlett Packard	C1533AI	\$929

4-8GB Sony SDT7000 \$909**TURBO SPEED 46MB/sec uncompressed or 90MB/sec with onboard compression!**

24-48GB HP	External 6 tape loader	C1553AX	\$2299
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48-96GB Seagate	C4586NP 12 tape autoloader		\$2399

SCSI 8mm DAT

3.5-7GB ExaByte	EXB8205XL	\$1269
7-14GB ExaByte	EXB8505XL	\$1889
7-14GB ExaByte	EXB8700LT	\$1029
20-40GB ExaByte	EXB8900	\$5499
70-140GB ExaByte	EXB10H 10 tape autoloader	\$5439

SCSI DLT 20-40GB Quantum DLT4000 \$4699**BACKUP SOFTWARE (SAVE \$10 with hard drive purchase)**

NovaStor's NovaBack CD contains software for DOS, Win 3.1, Win 95, OS/2, Warp, and Macintosh \$79

NovaStor's NovaDisk CD contains software to backup to disk drives and removables \$79

Seagate Arcada for Windows NT (call for network version) workstation/single server/enterprise \$239/499/869

TAPEDISK, allows DAT drive to be used as hard drive under DOS/Win 3.1, Win 95 \$189

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• IDE HARD DRIVES •

IDE	Speed	RPM	Brand	Model	Wty	Price
631MB	14ms	3600	Seagate	ST3630A	3	\$145
1200MB	10ms	5400	Fujitsu	M1636T	3	\$195
1275MB	12ms	4500	Seagate	ST31276A	3	\$195
1280MB	11ms	4500	Quantum	TM31280A	3	\$195
1281MB	11ms	5200	Western Digital	WDAC21200	3	\$199
1330MB	12ms	4480	Maxtor	M71336A	3	\$199
1624MB	10ms	5200	Western Digital	WDAC21600	3	\$219
1670MB	11ms	4480	Maxtor	M71670A	3	\$215
1700MB	10ms	5400	Fujitsu	M1623T	3	\$215
1700MB	12ms	4500	Seagate	ST31720A	3	\$215
1700MB	11ms	4500	Quantum	SR31700A	3	\$219
2004MB	11ms	4480	Maxtor	M72004A	3	\$255
2100MB	11ms	5200	Western Digital	WDAC22100	3	\$249
2100MB	9ms	5400	Fujitsu	M1624T	3	\$235
2132MB	12.5ms	4500	Seagate	ST32132A	3	\$247
2168MB	10.5ms	4500	Quantum	TM32160A	3	\$259
2500MB	9ms	5400	Fujitsu	M1638T	3	\$255
2550MB	15ms	3600	Quantum	BF2500A	3	\$242
2559MB	11ms	5200	Western Digital	WDAC32500	3	\$275
2560MB	11ms	5400	Seagate	ST5250A	3	\$275
2700MB	12ms	4480	Maxtor	M72700A	3	\$279
3166MB	12ms	5200	Western Digital	WDAC33100	3	\$302
3254MB	10.5ms	4500	Quantum	TM33200A	3	\$299
3500MB	12ms	4480	Maxtor	M83500A	3	\$369
3840MB	10.5ms	4500	Quantum	TM33840A	3	\$359

• SCSI HARD DRIVES •

SCSI	Speed	RPM	Brand	Model	Wty	Int	Ext
1050MB	9ms	5400	Seagate	ST31055N	3	\$339	\$399
1280MB	12ms	4500	Quantum	TM31280S	3	\$279	\$339
2050MB	8.5ms	7200	Micropolis	MC4221	5	\$545	\$599
2110MB	10.5ms	4500	Quantum	TM32110S	3	\$375	\$435
2147MB	9ms	5400	Quantum	MC4421	5	\$369	\$429
2147MB	9ms	5400	Micropolis	MC4421AV	5	\$429	\$489
2147MB	8ms	7200	Seagate	ST32550N	5	\$729	\$789
2150MB	9ms	5400	Seagate	ST32155N	5	\$479	\$539
2150MB	8ms	7200	Seagate	ST32171N	5	\$739	\$799
3254MB	10.5ms	4500	Quantum	TM33200S	3	\$449	\$509
4294MB	8ms	7200	Seagate	ST15230N	5	\$885	\$945
4294MB	8ms	7200	Micropolis	MC3243	5	\$829	\$889
4294MB	8ms	7200	Micropolis	MC3243AV	5	\$939	\$999
4350MB	8ms	7200	Seagate	ST34371N	5	\$1145	\$1205
4400MB	8ms	7200	Fujitsu	M2954S	5	\$819	\$879
4550MB	8ms	7200	Quantum	XP34550S	5	\$999	\$1059
4550MB	7.9ms	7200	Micropolis	MC4345	5	\$989	\$1049
9080MB	11ms	5400	Seagate	ST410800N	5	\$1779	\$1879
9091MB	8.5ms	7200	Micropolis	MC3391	5	\$1759	\$1819
9100MB	9ms	7200	Seagate	ST19171N	5	\$2085	\$2145
9100MB	8ms	7200	Quantum	XP39100S	5	\$1599	\$1659

WIDE SCSI

1050MB	9ms	5400	Seagate	ST31055W	5	\$379	\$509
2150MB	9ms	5400	Seagate	ST32155W	5	\$529	\$659
2150MB	8ms	7200	Seagate	ST32171W	5	\$779	\$909
4294MB	8ms	7200	Micropolis	MC3243W	5	\$929	\$1059
4294MB	8ms	7200	Micropolis	MC3243WD	5	\$899	\$1029
4294MB	8ms	7200	Micropolis	MC3243WAV	5	\$999	\$1139
4350MB	8ms	7200	Seagate	ST34371W	5	\$1189	\$1379
4550MB	7.9ms	7200	Micropolis	MC4345W	5	\$1020	\$1130
4550MB	8ms	7200	Quantum	XP34550W	5	\$999	\$1059
9091MB	8.5ms	7200	Micropolis	MC3391W	5	\$1809	\$1949
9100MB	11ms	5400	Seagate	ST410800W	5	\$2029	\$2219
9100MB	9ms	7200	Seagate	ST19171W	5	\$2149	\$2279
9100MB	8ms	7200	Quantum	XP39100W	5	\$1599	\$1659

Get an Adaptec wide PCI [A2940WKIT] for only \$289 when purchased with any Micropolis wide SCSI drive.





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- Up to 12.1" displays
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Model	CPU	Screen	RAM/HD	CD	Price
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520T	120MHz	11.3" Active	8/810MB	6X	2799
530T	133MHz	11.3" Active	16MB/1.3GB	6X	3499*
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* Includes built-in 28.8 fax modem

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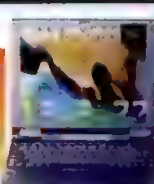


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LifeBook™ 600 Notebook

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635T	133MHz	12.1" Active	16MB/1.3GB	Opt.	\$3999
635T	133MHz	12.1" Active	16MB/1.3GB	Opt.	3999*

* Includes Windows for Workgroups or Windows 95

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420CDS	100MHz	11.3" Dual Scan	8/772MB	6X	\$2148
430CDS	120MHz	11.3" Dual Scan	16MB/1.2GB	10X	2499
420CDT	100MHz	11.3" Active	8MB/1.2GB	6X	2899
430CDS	120MHz	11.3" Active	16MB/1.2GB	10X	3399



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500CS	120MHz	12.1" Dual Scan	16MB/1.3GB	Opt.	\$2499
510CDS	133MHz	12.1" Dual Scan	16MB/1.2GB	10X	3699
500CDT	120MHz	12.1" Active	16MB/1.3GB	6X	4167
510CDT	133MHz	12.1" Active	16MB/2.1GB	10X	4999

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Model	CPU	Screen	RAM/HD	CD	Price
760EL	100MHz	11.3" Dual Scan	8/810MB	Opt.	\$3399
760ED	133MHz	12.1" Active	16MB/1.2GB	4X	5399
760E	150MHz	12.1" Active	16MB/2.1GB	Opt.	5699
760ED	133MHz	12.1" Active	16MB/2.1GB	6X	5999

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Model	CPU	Screen	RAM/HD	CD	Price
365XD	100MHz	10.4" Dual Scan	8/810MB	4X	\$1999
365X	120MHz	10.4" Active	8/810MB	Opt.	2299
365XD	120MHz	10.4" Active	8/810MB	4X	2499
365XD	133MHz	11.3" Active	8MB/1.4GB	6X	3499

Additional models available. Call for details.

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HiNoteVP & VP 500

Model	CPU	Screen	RAM/HD	CD	Price
HiNoteVP	120MHz	11.3" Dual Scan	8MB/1.08GB	Opt.	\$1499
VP 500	120MHz	11.3" Dual Scan	8MB/1.08GB	6X	2449
VP 500	120MHz	11.3" Active	8MB/1.08GB	6X	2949
VP 500	133MHz	12.1" Active	8MB/1.44GB	6X	3599

HiNote VP
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5-Year TAP Warranty...\$599.97

Model	CPU	Screen	RAM/HD	CD	Price
Ultra II	133MHz	11.3" Active	16MB/1.35GB	Opt.	\$4499
Ultra II	150MHz	11.3" Active	16MB/1.44G	Opt.	4659*
Ultra II	133MHz	11.3" Active	16MB/1.35GB	Opt.	4699**
Ultra II	150MHz	11.3" Active	16MB/1.44G	Opt.	4799

* Features Win for Workgroups ** Features Win NT

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5-Year TAP Warranty...\$399.97

LTE 5000

Model	CPU	Screen	RAM/HD	CD	Price
5250	120MHz	10.4" Active	16/810MB	Opt.	\$3169
5280	120MHz	11.3" Active	16MB/1.35GB	Opt.	3859
5300	133MHz	12.1" Active	16MB/1.35GB	Opt.	4349
5380	133MHz	12.1" Active	16MB/2.2GB	Opt.	5439
5400	150MHz	12.1" Active	32MB/2.2GB	Opt.	5539

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LTE 5000

Model	CPU	Screen	RAM/HD	CD	Price
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Model	CPU	Screen	RAM/HD	CD	Price
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9080	133MHz	12.1" Active	16MB/1.3GB	6X	4499

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Sharp
WideNote

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MODEL**

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W100T	133MHz	11.2" Wide Active	16MB/1.1GB	Opt.	3499

NEC



NEC Versa 6030X

Versa 6000

Model	CPU	Screen	RAM/HD	CD	Price
6010H	133MHz	11.3" Active	16MB/1.08GB	6X	\$3649
6030H	133MHz	12.1" Active	16MB/1.3GB	6X	4999
6030X	133MHz	12.1" Active	16MB/1.4GB	6X	5399

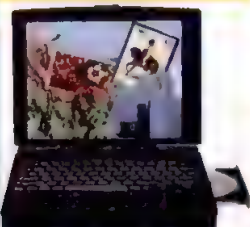
Versa 4200

Model	CPU	Screen	RAM/HD	CD	Price
4200	100MHz	10.4" Active	8/810MB	Opt.	\$2999
4230	133MHz	10.4" Active	8MB/1.0GB	6X	3899

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Versa 6000
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Extensa 600CD

Extensa 600

Model	CPU	Screen	RAM/HD	CD	Price
600CD	120MHz	12.1" Dual Scan	8/810MB	6X	\$1819

TravelMate 6000

Model	CPU	Screen	RAM/HD	CD	Price
6020	120MHz	11.3" Active	8MB/1.08GB	Opt.	\$3199
6030	133MHz	12.1" Active	16MB/1.35GB	Opt.	3699
6050	150MHz	12.1" Active	16MB/1.35GB	Opt.	3899
6050MT	150MHz	12.1" Active	32MB/1.1GB	10X	4699*

*Includes Windows NT 4.0 Workstation

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Echoes

Model	CPU	Screen	RAM/HD	CD	Price
Echoes	100MHz	11.3" Dual Scan	8MB/1.3GB	6X	\$1859
Echoes	100MHz	10.4" Active	8MB/1.3GB	6X	2149
Pro	133MHz	12.1" Dual Scan	16MB/1.3GB	8X	3499
Pro	133MHz	12.1" Active	16MB/2GB	8X	3999
Pro	150MHz	12.1" Active	16MB/2GB	8X	4199

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5-Year TAP Warranty... \$299.97

Olivetti Echoes Notebook

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Hitachi Mx
Notebook

Hitachi E

Model	CPU	Screen	RAM/HD	CD	Price
E100D	100MHz	11.3" Dual Scan	16/810MB	Opt.	\$1799
E133D	133MHz	11.3" Dual Scan	16/1.08GB	Opt.	1999
E133T	133MHz	11.3" Active	16/810MB	Opt.	2599

Hitachi Mx

Model	CPU	Screen	RAM/HD	CD	Price
MX133T	133MHz	12.1" Active	16MB/1.35GB	8X	\$3999
MX150T	150MHz	12.1" Active	16MB/2.1GB	8X	4699

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5-Year TAP Warranty... \$349.97

Ascentia A & P

Model	CPU	Screen	RAM/HD	CD	Price
A41	120MHz	11.3" Dual Scan	16MB/1.0GB	6X	\$2199
A42	120MHz	12.1" Active	16MB/1.0GB	6X	2799
P50	133MHz	12.1" Active	24MB/1.0GB	6X	3899*
P50	133MHz	12.1" Active	24MB/2.1GB	6X	4299*

* Features 28.8 fax modem

Ascentia J

Model	CPU	Screen	RAM/HD	CD	Price
J20	100MHz	11.3" Dual Scan	8/810MB	Opt.	\$1299
J55	133MHz	11.3" Active	16MB/1.0GB	Opt.	2399

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HP OmniBook
800 Notebook PC

HP OmniBook 800

Model	CPU	Screen	RAM/HD	CD	Price
800CS	100MHz	10.0" Dual Scan	16/810MB	Opt.	\$2449
800CT	133MHz	10.4" Active	16MB/1.4GB	Opt.	4279

HP OmniBook 5500

Model	CPU	Screen	RAM/HD	CD	Price
5500CTS	120MHz	10.4" Active	16MB/1.35GB	Opt.	\$3129
5500CTS	133MHz	12.1" Active	16MB/1.35GB	Opt.	4029
5500CTS	133MHz	12.1" Active	16MB/2GB	Opt.	4379

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- 3D stereo audio and graphics

Model	CPU	RAM/MB	CD	Price
7320	166MHz MMX	16MB/2.1GB	16X	\$1799
7360	200MHz MMX	32MB/3.8GB	16X	2499

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- 3D stereosound with Theater Sound™

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S64	166MHz	16MB/2.5GB	8X	\$1999
S66	166MHz	16MB/3.2GB	8X	2169*
S74	200MHz	16MB/2.5GB	8X	2229
S78	200MHz	16MB/3.5GB	8X	2499*

* Cordless mouse and joystick included

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Model	Size	View	Resolution	Price
MM50	15"	13.7"	1024 x 768	\$499
MM70	17"	15.7"	1024 x 768	799

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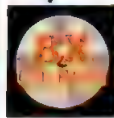
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- Up to 2.5GB hard drives

Model	CPU	RAM/MB	CD	Price
4704	133MHz	16MB/1.6GB	6X	\$1599
4712	166MHz	24MB/2.5GB	6X	1899
4716	200MHz	32MB/2.5GB	8X	2199

Presario Monitors

Model	Size	View	Resolution	Price
Presario	14"	12.9"	1024 x 768	\$399
Presario	15"	13.5"	1024 x 768	479
Presario	17"	15.6"	1280 x 1024	749

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- 2MB EDO video RAM
- Tons of FREE software



Model	CPU	RAM/MB	CD	Price
7130	133MHz	16MB/1.6GB	8X	\$1299
7160	166MHz	16MB/2.1GB	8X	1599
7200	200MHz	16MB/3.0GB	8X	2199

Infinia Monitors

Model	Size	View	Resolution	Price
Infinia	15"	13.78"	1280 x 1024	\$459
Infinia	17"	16.23"	1280 x 1024	759

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Jump from CD to TV
to radio to answering
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SONY

Model	CPU	RAM/HD	CD	Price
VAIO	166MHz	32MB/2.1GB	8X	\$1999
VAIO	200MHz	32MB/2.5GB	8X	2299

VAIO Monitor

Model	Size	Resolution	Price
VAIO	15"	13.9"	1280 x 1024
			\$579

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\$1999
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Sony VAIO Multimedia

VAIO Multimedia

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- Over 30 pre-installed software titles
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- 3D accelerated graphics with MPEG support

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Advantage Adventure Multimedia

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- 8X CD-ROM drive
- MPEG Level 1 playback support
- 33.6 data/fax voice modem
- 3-D graphics and sound
- Loads of FREE software

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Model	CPU	RAM/HD	CD	Price
9402	166MHz MMX	16MB/2.0GB	8X	\$1799
9404	200MHz MMX	16MB/2.0GB	8X	1999

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Ready Multimedia

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- Tons of FREE software
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Model	CPU	RAM/HD	CD	Price
7622	120MHz	16MB/1.6GB	8X	\$1499
9620	133MHz	16MB/1.6GB	8X	1699
9624	133MHz	16MB/2.0GB	8X	1799
9622	166MHz	16MB/2.5GB	8X	1899
9628	166MHz	32MB/3.2GB	8X	1999
9629	200MHz	32MB/3.2GB	8X	2699

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- 8X CD-ROM drive
- Up to 33.6 speed fax modems
- Tons of FREE software

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AMD	133MHz	8/850MB	8X	\$999
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Cyrix	166MHz	16MB/2.5GB	8X	1699
Cyrix	200MHz	32MB/2.5GB	8X	1999

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Cyrix Processor
\$1499
3-Year TAP Warranty... \$149.97
5-Year TAP Warranty... \$229.97

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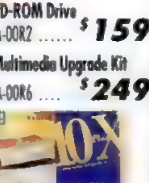
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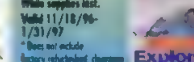
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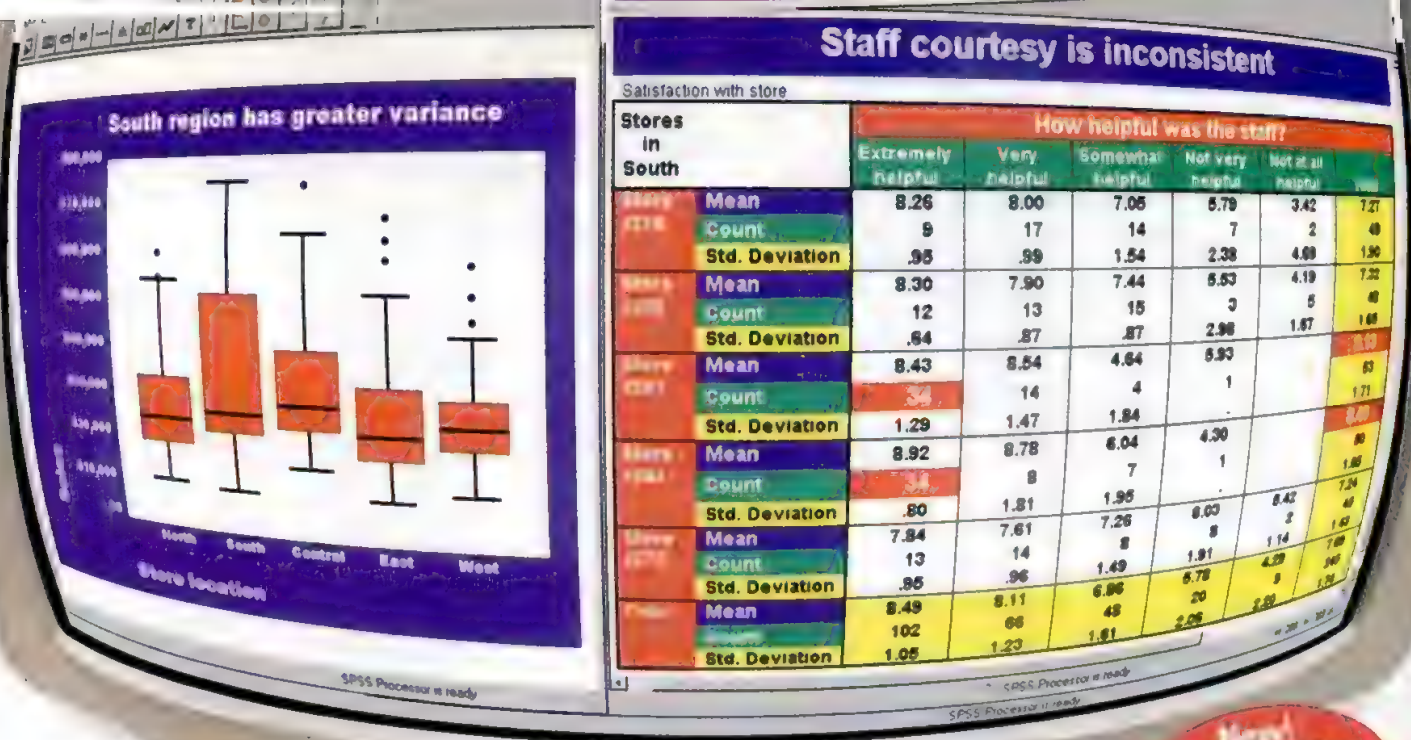
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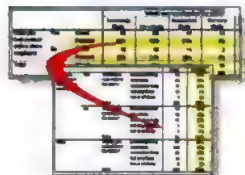
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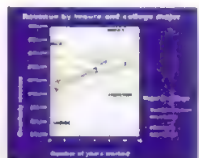
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34103	Pentium 100	1.0GB	8/72MB	Opt.	\$1999
34104	Pentium 120	1.44GB	16/90MB	Opt.	2999
35356	Pentium 133	1.44GB	16/90MB	Opt.	2699
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33495	AcerNote Light	372	16MB/1.0GB	2399
33496	AcerNote Light	373	16MB/1.3GB	2699
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- 727MB HD
- Integrated AC Adapter

Item #	Model	RAM/HD	Price
30436	Satellite 110CT	8MB/772MB	\$1999
30438	Satellite Pro 420CDS	8MB/1.2GB	2849
30440	Tecra 500CS	16MB/1.3GB	3799

Satellite Pro 420CDS

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Satellite Pro 420CDS

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34343	Pentium/133	4794	16MB/1.6GB	6X	1599
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34103	Pentium 100	1.0GB	8/72MB	Opt.	\$1999
34104	Pentium 120	1.44GB	16/90MB	Opt.	2999
35356	Pentium 133	1.44GB	16/90MB	Opt.	2699
35359	Pentium 150	2.1GB	16/90MB	Opt.	4499

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32953	AMD K5-100	8MB/850MB	999
30476	CYRIX P150+	16MB/2GB	1199
31053	CYRIX P200+	32MB/2.5GB	1699

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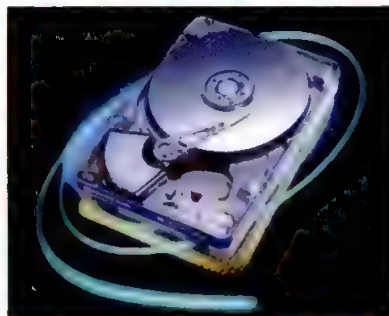


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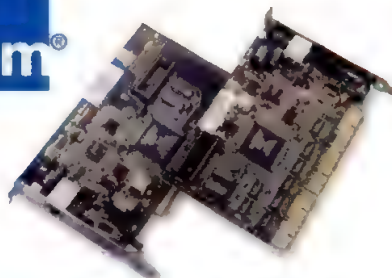
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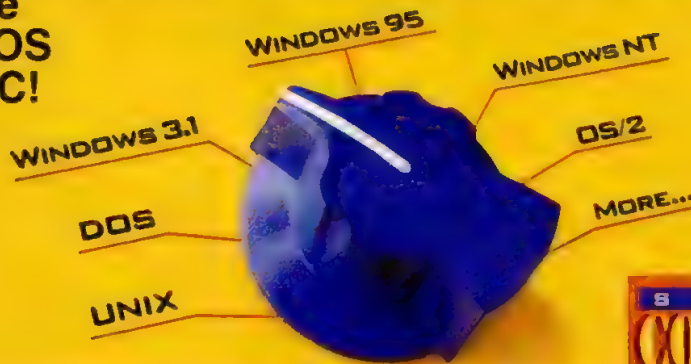
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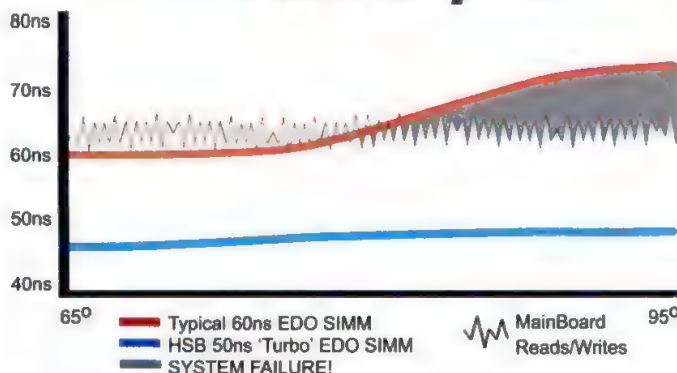
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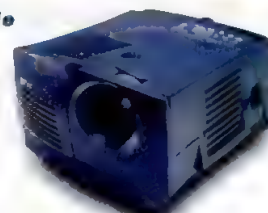
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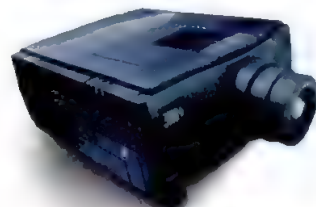
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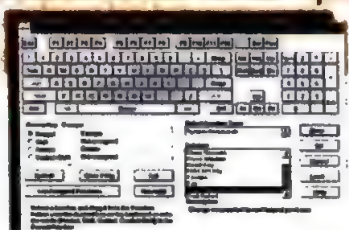


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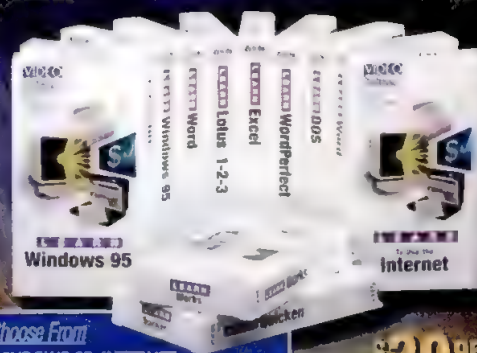
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Virus Bulletin

July 1996

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January 1996

OVERALL RECOGNITION OF VIRUSES

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Summer 1996

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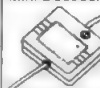
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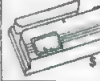


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The (Almost) Perfect Role-Playing Game

Bethesda's new RPG is a true epic, but it suffers from numerous bugs.

The Elder Scrolls: Daggerfall

The Elder Scrolls: Daggerfall, Bethesda Software's new DOS-based role-playing game (RPG), is a revolutionary title that delivers a unique gaming experience. In fact, this may be the best RPG since Origin's Ultima IV, despite the fact that the game is rife with bugs.



Daggerfall is the sequel to The Elder Scrolls: Arena, which set a new standard for action. Now Daggerfall takes Arena's open-ended plot and expands on it by an order of magnitude.

As in any RPG, you begin by creating a character. You can either choose a preset class, such as fighter, mage, or thief, or create your own. Here, each character type has a set of skills that determines his development; this sets the game apart from most RPGs, in which *development* means "number of monsters killed."

Also impressive is the game's reputation system, which determines how other characters are going to react to you.

As the story opens, your character is asked to travel to the city of Daggerfall, where the ghost of a former king haunts the streets, crying out for vengeance. No one seems to know who or what could have disturbed his spirit, so it is up to you to find out. On the way, you are shipwrecked by a storm and barely manage to save yourself. You crawl into a mysterious cavern, and then the game begins in earnest.

Your first goal is to escape from the cavern and get to Daggerfall. After that, you're on your own: You can follow the game's plot or not, be good or live a life of crime (the latter choice, we have to admit, is downright fun).

You can and should wander around town, talking to the locals and visiting the shops. Talking to a few key political figures you encounter leads you to a handful of quests that tie into the game's central plot.

In pursuit of that plot or simply for adventure, you can set out to visit the thousands of



other towns and dungeons in Tamriel, a vast virtual world of over 30,000 square miles.

The best course is to find work so you can gain experience and build up a bank account. Stores and taverns offer occasional menial tasks (mostly deliveries), but the best jobs come from the guilds. These organizations can provide a steady stream of work and money along with other members-only benefits.

The game uses a low-resolution but impressive 320-by-200-pixel VGA graphics engine, and all the action takes place from a first-person perspective. Unfortunately, although the movement commands are customizable, they are not very intuitive.

Also, the game does not seem to run well unless you choose the 200MB or 450MB installation option. That's a lot of real estate on any system.

Last, we were shocked by the number of bugs and glitches in the game: frequent crashes, missing text and graphics, and errors in the 3-D engine. Bethesda has been very responsive to user complaints, delivering frequent patches, but we feel that most of these problems should have been fixed before the game shipped.

Yet despite the game's idiosyncrasies and bugs, we found ourselves hopelessly addicted to Daggerfall's endless possibilities and game play. If you're an RPG fan, the same fate is likely to befall you.—Michael E. Ryan

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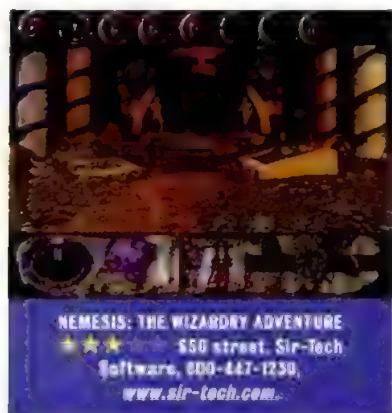
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Looking for Adventure?

Three solid games for fans of fantasy, science fiction, or simply the bizarre.

Nemesis: The Wizardry Adventure

Just over 15 years ago, a little-known company, Sir-Tech Software, quietly released a game called Wizardry. This brilliant role-playing game (RPG) not only led to a successful series of sequels and add-ons but garnered a huge cult following, indelibly stamping itself



into the hearts and minds of computer gaming fans.

Now comes Nemesis: The Wizardry Adventure. And while this five-CD epic contains only the barest hint of its RPG roots, it is a truly pleasant adventure game.

The setting is a place called Galican—your home. Galican is filled with jolly medieval folk who dwell in thatched-roofed houses. One day, while you're minding your own business, a winged creature suddenly picks you up and carries you off. Only the quick thinking and magical skill of Galican's sage, Rian, saves you from the beast.

Apparently, a long-dead magic that leveled whole civilizations has reawakened and, for some obscure reason, set

its sights on you. Rian says that you must learn his magic if you're to protect yourself, so you begin your exploration of Galican, looking for clues as to how to stop this evil before it destroys you and your home.

You wander about and view your surroundings in a first-person perspective that is a cross between free-scrolling and Myst-style, one-scene-per-step types of games. Although not quite on a par with those in Activision's Zork Nemesis (no relation), the graphics are impressive and set the fantasy theme well.

To finish the game you must wander from place to place, assembling and using a limited inventory. You may also have as many as 16 spells at your disposal.

Those expecting an RPG in the Wizardry tradition will be disappointed by Nemesis. But for fantasy fans looking for a good adventure, Sir-Tech has delivered a solid title.—Shane Mooney

The Neverhood Chronicles

Not only is The Neverhood Chronicles not your typical adventure game, it's the most unusual game we've seen since Bad Mojo. DreamWorks Interactive has constructed a bizarre but highly enjoyable game entirely of clay. And since it sprung from the same mind that brought us Earthworm Jim, it's clay with plenty of attitude.

The Neverhood immerses you in a world that might have

been spawned by hallucinating preschoolers. Three tons of clay and over 50,000 frames of stop-motion animation were used to create this surreal world of oversize Venus's flytraps, evil mutant clay creatures, and plenty of slapstick.

The story finds you, Klaymen, waking up in a room with no clue as to how you got there, where "there" is, or what it is you're supposed to do now that you're there. Eventually, you learn that you must save the Neverhood by navigating through a twisted plot of ancient secrets, witty inventions, and monstrous puzzles to defeat a nasty foe.

Using a very simple interface, you point and click where you want to go. If some object can be picked up or used along the way, you'll perform the task automatically.

While you wander around, you find yourself faced with a puzzle in nearly every building you enter. The puzzles start out relatively easy and progressively become much harder. Young and inexperienced gamers may find themselves frustrated by the last quarter of the game (DreamWorks recommends that players be 17 or older; we agree).

The actual game play is genuinely entertaining, and the cut-scenes throughout the game are hilarious. But the best part is that there is almost no way you can get killed. Like Mr. Bill, you can be smooshed, mashed, and even decapitated, but you'll pop right back to your whole self in no time.

If you liked watching Wile E. Coyote go boom on Saturday mornings when you were younger, then you'll love spending some time in the Neverhood.—SM

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Game play is your standard adventure fare: Find

puzzle, interact with puzzle, solve puzzle. And from start to finish, the puzzles here are some of the toughest around.

The rich environment is fairly compelling, and as crew members start disappearing and dying, things really begin picking up. Soon you'll find yourself pulled into the world of Rama, not wanting to let go until you have solved all its mysteries.—SM

QUICK CLIPS



America Rock

Another solid release from Creative Wonders, this one includes the ever-popular "I'm Just a Bill" cartoon and some enjoyable history-learning games. \$34.95 list; Creative Wonders, 800-543-9778.



NecroDome

A futuristic, automotive action game developed by Raven Software (creators of Heretic and Hexen), NecroDome is fast-paced and a lot of fun though difficult to master. The movement commands are especially tough. \$45 street; Strategic Simulations Inc., 800-601-7528.



Perfect Plants

An impressive guide for anyone interested in gardening, Perfect Plants is full of helpful information tips for easier, improved plant care. \$35 street; Maxis, 800-336-2947.



Disney's Power Play: Toy Story

An arcade game that could have been so much fun... isn't. Odd level designs and occasionally flaky controls hinder this disappointing CD-ROM. \$32.95 direct; Disney Interactive, 800-900-9234.

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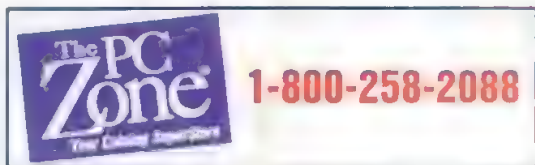
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A Hero We Can Relate To

Humongous Entertainment's latest kids' adventure is an instant classic.

Pajama Sam might be the youngest caped crusader to fight the forces of evil, but he's certainly up to the task in the CD-ROM adventure game Pajama Sam in No Need To Hide When It's Dark Outside. Like most super heroes, Pajama Sam has a secret identity: young Sam, whose fear of Darkness sparks him to great acts of valor. Armed with his mask, his Illuminator Mark V flashlight, and his Signature Edition All-Metal Pajama Man lunch box (or Portable Bad Guy Containment Unit), Sam rushes headlong into his closet to conquer Darkness so he won't need to sleep with the light on anymore.

In this vibrantly colored, appealingly animated world designed for children ages 3 to 8, you become Sam and face up to Darkness on the bad guy's home turf. You meet your first challenge almost immediately: You get stopped by the Custom Trees, who confiscate your superhero gear. You can't defeat Darkness without your stuff, so first you have to track it all down.

As you wander around the Land of Darkness in search of your gear, you meet Otto the Rowboat, King the Mine Car, and Carrot X (our favorite, a hip vegetable revolutionary). Throughout these encounters, you learn the value of teamwork: You help these folks with their particular problems and they help you find your gear. Finally, you are ready to fight Darkness.

Appropriately scary-looking

and tricky to enter, Darkness's house is nevertheless a really fun place. Some of the highlights include a den of dancing furniture, a kitchen full of singing utensils, and a music room of talking instruments.

Every time you start Pajama Sam, there are subtle differences. Each clue leads both forwards and backwards; you may find a superhero item but not be able to reach it, so you have to backtrack and find the right tool to retrieve the item. The tool in



question is in a different place altogether, so you'll hone those memory skills along the way.

Pajama Sam promises hours of fun and surprises, no matter

how many times you and your kids play it. This game definitely stands up as one of the finest children's software titles we've seen.—*Mary E. Behr*

Come Get Some More

That irreverent action hero is back with new foes and a new toy.

The Plutonium Pak

Load the weapons and hide the children, because Duke Nukem is back. The Plutonium Pak is an all-new, 11-level episode for use with the original Duke Nukem 3D action game.

True to its lineage, this new

scenario starts out in questionable if not downright offensive fashion. It seems that the aliens you were supposed to have defeated in Duke Nukem 3D have impregnated a human woman, and she's about to give birth. If you're not disgusted and insulted at this point,

chances are you're a fan of the original game and you'll like this one as well. So you set out on your renewed antialien campaign, which, story line aside, stands out as one of the most enjoyable action shoot-'em-ups around.

You'll face the same cast of alien

bad guys that you faced in the original, but with two notable additions. One, a huge jumping creature reminiscent of the *Alien* movies, spits green stuff that shrinks you. The other is a tank-driving variation of the original game's pig trooper.

Never fear, you'll have a new gun to use against these foes: Point the new microwave ray at these alien scumbags and watch them expand until they burst.

The new levels are even better and more challenging than those in the original game. One of the many themed levels is a well-designed knockoff of the movie *Mission: Impossible*.

Duke Nukem 3D fans will enjoy the extra carnage this add-on provides, but keep in mind that you do need the original to play. Also, this time around you must have the CD-ROM in the drive to launch the game (a fact that's sure to annoy the software pirates out there).—*MER*



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Web Content Comes to You

Time was, if you wanted Web content, you had to know where it was, then go get it. Now, Web content is coming to you. An increasing number of new Internet services actively deliver customized news, stock quotes, and even software to your desktop while you work. We review a dozen of these new tools that deliver timely material and cast an eye toward the future of this emerging field.

Top 100 Web Sites

Your bookmark list is due for an update. We search out the Web's Top 100 sites to find the most useful, the most cutting-edge, and the most fun. Find out which sites offer the most compelling mix of content, design, and technology.

Tax Preparation Software

It's tax time, so it must also be time for our annual roundup of tax preparation software. This year, we look at four Windows-based products and a handful of products for DOS and OS/2, along with a wealth of tax preparation sites on the Web.



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NE—Network Edition.

For information about the Network Edition of PC Magazine, call Circulation at 800-289-0429.

Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

Special Haiku Edition

Greetings, poets. In the November 5, 1996, edition of Abort, Retry, Fail?, we asked you to pen lyrical, mystical haikus about the fantastic world of computing. We promised to award prizes to the writers of the top three entries, and so we shall. Here, for your edification and entertainment, are the winners, along with some other heartfelt haikus worthy of honorable mentions—plus a few that should probably be dealt one swift stroke of a samurai sword.



**My PC, it's true,
Much like the little haiku,
Comes from Japan, too.**

—Kevin Leman*

**Which browser is best?
You're not a dumb terminal;
Why don't you tell me?**

—Dave Kuhn



**My girlfriend is mad.
I surf on the World Wide Web
Until she's asleep.**

—Bill Loytty*

**Pentium my love,
I'll never be without you
(Until P7).**

—Grant Karlin



**Windows 95—
I've got to have it right now!
Am I a lemming?**

—Ken Keilman*

**Monitor, modem,
Printer and peripherals...
Peace... prosperity.**

—Gordon Geison

**Technolust has me.
DVD, MMX soon,
My computer dreams.**

—David Grunwell

**Windows 95
Has killed my mighty laptop.
Oh thanks, Microsoft!**

—Mark Nitsche



**Together all night,
But by the monitor's glow.
My wife sleeps alone.**

—Kevin Steffen

**That one looks real nice,
A real sexy CPU.
Want my wife for it?**

—George Lin



If your entry is used, we'll send you \$50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802 or, via e-mail (text items only), to don_willmott@zd.com. * Winners this issue.

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3.1	DELL COMPUTER	Latitude LM P133ST, 12-in. TFT display, (133 Mhz)	6.8 lb, 16MB RAM, 810MB disk, 6X CD-ROM	Great
2.8	IBM PC CO.	ThinkPad 760ED 1, 2-in. TFT display (133 Mhz)	1.7GB disk, 4X	
2.8	WINBOOK COMPUTER	WinBook 11.5		
2.7	COMPAQ COMPUTER			
2.7	HEWLETT-PACKARD			

— Business Week, November 4, 1996 —

What's wrong with this picture? The notebook that gives you the most performance, usability and features costs half the price of notebooks that give you less. (Notebooks, by the way, that you probably thought gave you more.) And remember, you have this information on the very best authority. *Business Week*, the business publication, in their Second Annual Computer Buying Guide cited the Dell Latitude LM P133ST as "the top ranked machine in the tests" and the notebook they'd most like to travel with. So if you're shopping for a notebook, buy the best. After all, you can afford it.



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